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ABSTRACT

GRADES OR AGES: Grades 9 and 10. SUBJECT MATTER: Biology I. ORGANIZATION AND PHYSICAL APPEARANCE: After the introductory material and a bibliography of reference materials and teaching aids, the guide is divided into four units: 1) The Historical Development of Biology, 2) Unity of Patterns of Living Things, 3) Diversity of Structure and Functions, 4) Continuity of Life. The material for each unit is set out in four columns: concept, content, suggested activities, and resource materials. The guide is mimeographed and spiral bound with a soft cover. OBJECTIVES AND ACTIVITIES: Objectives are listed at the beginning of each unit. Activities are listed for each unit. INSTRUCTIONAL MATERIALS: A list of basic textbooks, reference materials and teaching aids is provided at the beginning of the guide. Specific references to resource materials are given in each unit. STUDENT ASSESSMENT: Published tests to be used at the end of each unit are indicated, but no other evaluation is included. (MBM)

ED050066

BIOLOGY I

SCIENCE CURRICULUM GUIDE
Grades 9-10

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
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SCHOOL CITY OF GARY
Gary, Indiana
1968

SP007113

TABLE OF CONTENTS

page

ACKNOWLEDGEMENTS ii

PREFACE iii

TO THE TEACHER v

TEXTBOOKS AND SUPPLEMENTARY REFERENCE MATERIALS vii

UNIT 1: THE HISTORICAL DEVELOPMENT OF BIOLOGY 1

UNIT 2: UNITY OF PATTERNS OF LIVING THINGS 9

UNIT 3: DIVERSITY OF STRUCTURE AND FUNCTION 33

UNIT 4: CONTINUITY OF LIFE 77

ACKNOWLEDGEMEN

The unselfish and dedicated assistance given by teach
in the preparation and production of this guide is ac
collective skills and efforts; their keen sensitivit
siastic and dedicated support, such a guide would hav

The greatest amount of credit, however, for the plann
accorded those faithful and dedicated classroom teach
and experiences, have become sensitive to the interes
will be influenced by this guide. It is this same gr
students to make the goals set forth in this guide a

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- ACKNOWLEDGEMENTS -

ated assistance given by teachers, principals, and central office personnel production of this guide is acknowledged with appreciation. Without their fforts; their keen sensitivities to the needs of students and their enthu- upport, such a guide would have been impossible.

credit, however, for the planning and development of the guide must be and dedicated classroom teachers, who through their professional training ecome sensitive to the interests, needs, and aspirations of children who his guide. It is this same group of teachers who must work with the als set forth in this guide a reality.

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Biology Subcommittee

Floyd Conard	- West Side High School
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PREFACE

Biology I is a general education course offered in the Gary Public S
is strongly felt that each student must possess certain basic knowle
himself, and the interaction that takes place between himself, his b
Since readiness plays a very important role in motivation and achieve
permitted to enroll in biology when their readiness is identified. T
that the majority of students show a readiness at the tenth grade le
at the ninth grade level. Scientific research and technology has br
in knowledge in the field of biology and other related sciences. Si
fifteen years, have also been made in areas concerned with teaching

This biology guide has been prepared by the School City of Gary as a
bring the teaching of biological sciences in line with modern concep
In so doing, it is hoped that it will reflect the best techniques and
available. An attempt has been made to retain the better aspects of
unrelated portions of the new. In so doing, philosophies have been
general and specific, were revised; methods of teaching and learning

It is hoped that the application of these stated aims and objective
and the student so that both may realize those goals set for themsel
Gary. An attempt is made on the following page to present some basi
realization of those aims and objectives referred to above.

Children learn best by doing! It is through this avenue that learni
preparing children for the world of today and tomorrow. Much of the
centered around student-involved activities. This can best be accom
upon laboratory-oriented experiences. This is not laboratory of the
it is exploratory experience, dealing with problems which are either
become real in the setting in which it is presented. Ideally, such
tutes the core of the learning process and subject matter becomes pe

PREFACE

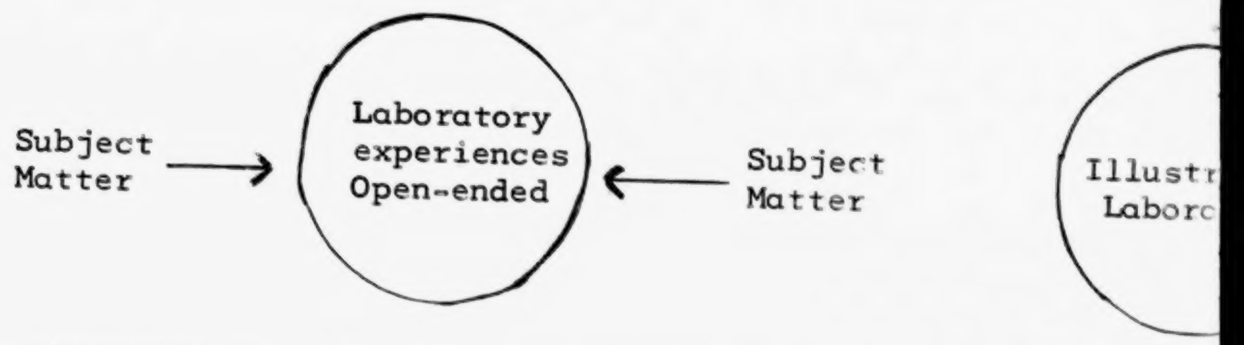
on course offered in the Gary Public Schools to students because it
dent must possess certain basic knowledge and understanding about
hat takes place between himself, his biotic and physical environment.
mportant role in motivation and achievement, students should be
when their readiness is identified. Though past experiences reveal
show a readiness at the tenth grade level, some exhibit a readiness
entific research and technology has brought about tremendous gains
iology and other related sciences. Significant gains, over the past
made in areas concerned with teaching methods and learning theories.

epared by the School City of Gary as a part of that major effort to
al sciences in line with modern concepts of teaching and learning.
it will reflect the best techniques and learning materials currently
n made to retain the better aspects of the old and to eliminate
In so doing, philosophies have been modified; objectives, both
ised; methods of teaching and learning were given prime consideration.

on of these stated aims and objectives will strengthen the teacher
ay realize those goals set for themselves and the School City of
he following page to present some basic ideas essential to the
objectives referred to above.

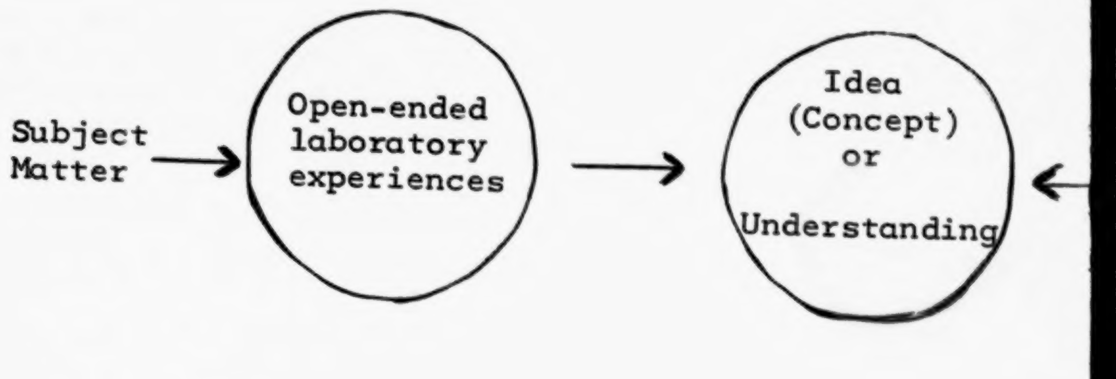
It is through this avenue that learning has its greatest utility in
ld of today and tomorrow. Much of the teaching process should be
ed activities. This can best be accomplished by placing stress
iences. This is not laboratory of the conventional illustrative type--
ealing with problems which are either real to the students or which
which it is presented. Ideally, such laboratory experience consti-
process and subject matter becomes peripheral and contributory to it.

EXAMPLE:

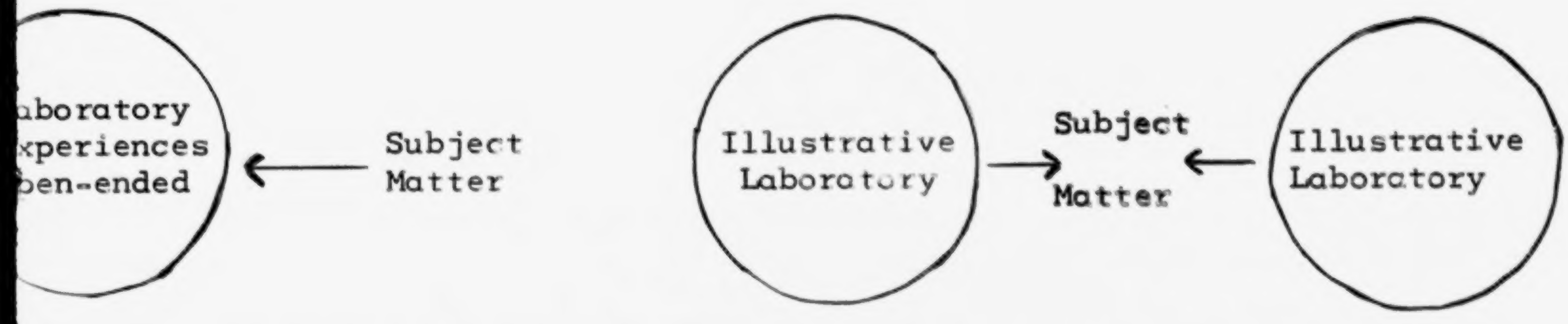

Subject Matter
Laboratory experiences Open-ended
Subject Matter
Illustr
Laborc

Laboratory experiences of open-ended type may be of little vo
generate, unless they are planned to lead toward significant

EXAMPLE:


Subject Matter
Open-ended laboratory experiences
Idea (Concept) or Understanding

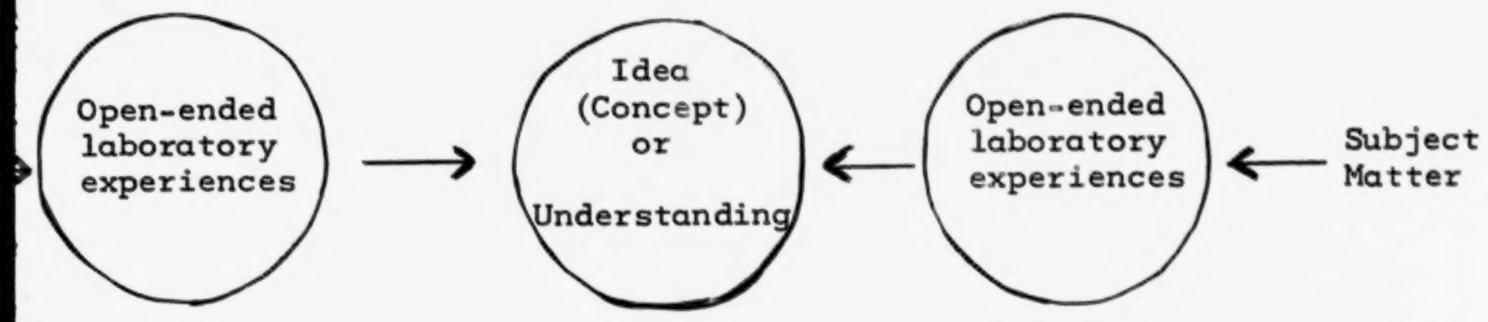
EXAMPLE:



boratory
xperiences
pen-ended
Subject
Matter
Illustrative
Laboratory
Subject
Matter
Illustrative
Laboratory

nces of open-ended type may be of little value beyond the interest that they
hey are planned to lead toward significant ideas or understandings.

EXAMPLE:



Open-ended
laboratory
experiences
Idea
(Concept)
or
Understanding
Open-ended
laboratory
experiences
Subject
Matter

TO THE TEA

The purpose of the committees and teachers who assist
which are consistent with objectives of science instr
meaningful relationship to one another. The concepts
toward those ideas. Since these activities are open-
inquiry. The heart of the inquiry method, however, l
and students. Although the students should be allowe
activities which are not directed toward the developm
standings are considered to be of little value.

Modern science curriculum studies list as an objective
laboratory activities are a part of inquiry; but by no
a set of facts to be learned or a list of problems to
learning through inquiry (process).

Much of the conventional educational process tends to
than nurture it. Much of the natural curiosity of stu
ledge given in answer to questions, and, consequently
answered. This is true both of the questions that ar
students are allowed to ask. Emphasis on the retentio
limitation. Teachers ask students questions which, ho
knows the answer. Questions that the teacher cannot a
lead to approval when they are asked by students. Suc
leading nowhere, and at worst, as an attempt on the pa
the prescribed work of the course. Yet, it is the una
heart of the inquiry process.

It is at this point that the teacher can say: "I do n
does. We can look for the answer, collect evidence, a
might be, but we cannot be sure." This is research!

Questions should be asked (and allowed) at four differ
1. Those which can be answered readily from the exp
   general knowledge.
2. Those that can be answered, only after considera
3. Those which cannot be answered by either student
4. Those which probably cannot be answered at all w

TO THE TEACHER

nd teachers who assisted in developing this guide has been to choose ideas
tives of science instruction and general education and which exhibit a
another. The concepts and laboratory experiences are planned to lead
se activities are open-ended, they, in themselves, involve a process of
iry method, however, lies in the questions which are asked by teacher
dents should be allowed wide freedom in investigation, laboratory
ed toward the development of significant ideas, concepts, or under-
of little value.

ies list as an objective the teaching of science as inquiry. Open-ended
t of inquiry; but by no means all of it. Science should not be considered
a list of problems to be solved. It should be viewed as an attitude of
ss).

ional process tends to stifle inquiry on the part of students rather
atural curiosity of students can be destroyed by emphasis on specific know-
ons, and, consequently, on the asking only of those questions that can be
the questions that are asked students, and also of the questions which
mphasis on the retention of knowledge as an end in itself fosters this
ents questions which, hopefully, they can answer, and to which the teacher
at the teacher cannot answer, and perhaps no one can, do not generally
asked by students. Such questions are viewed, at best, as being useless or
as an attempt on the part of the students to lead the teacher astray from
rse. Yet, it is the unanswered and unanswerable questions which form the

eacher can say: "I do not know the answer, and I doubt if anyone else
wer, collect evidence, and possibly make a judgment as to what the answer
e." This is research!

allowed) at four different levels:
red readily from the experience and materials at hand, together with

ed, only after considerable investigation and thinking.
swered by either students or teacher.
not be answered at all with our present knowledge.

Only by maintaining this questioning attitude as an a
science can students be led to develop the research a
in this guide, constructed for open-ended procedure a
levels indicated above, constitute ideal vehicles for
inquiry with relation to the specific ideas toward wh

The format of the guide is designed to present basic c
within the mind of students by exposing them to selec
activities.

The multi-sensory approach seems to provide the best m
therefore, should not rely upon any one book or text a
students wide latitude to explore both historic and cu
standing of the inter-relationships of these basic con
develop principles and make generalizations about life

References to chapters, pages and time allotments have
organization will stimulate the teacher to search a va
will lead students to an understanding of the desired
students exhibit varying degrees of abilities and expe
differences existing within a classroom, or school, or
establish an allotment of time for any learning experi-
mastery of those skills that will best prepare student
and because of the increasing numbers of beginning tea
a large majority of students who are unfamiliar or slic
ials set forth in this guide, meaningful time allotmen

Success in using the materials in this guide depends,
fulness and originality. The ideas and concepts towarc
teach themselves. These concepts and ideas must be se
should always involve the recording and interpretation
based on weighing, measuring, counting, or other types

It is with these thoughts and ideas in mind that the co
this guide as a tool and a method of instruction that w
program in biology in the Gary Public Schools. Those t
and the methods advocated in this guide will share in t
challenges and demands of the hour and subsequently wil
instruction along the continuum of education. This ult
standing of our environment and point the way toward a

tioning attitude as an approach to the materials and experiences of
o develop the research attitude. The laboratory experiences suggested
r open-ended procedure and guided with questions pitched at the four
itute ideal vehicles for use by teachers and students in carrying on
specific ideas toward which they are directed.

signed to present basic concepts which the teacher should develop
y exposing them to selected subject content and related learning

ems to provide the best means of achieving this objective. A teacher,
on any one book or text as an authority, but allow himself and the
lore both historic and current materials. It is through the under-
nships of these basic concepts that the students can form new concepts,
eneralizations about life.

and time allotments have been disregarded for several reasons. Such
he teacher to search a variety of materials for subject content that
rstanding of the desired concepts. Moreover, each teacher and group of
es of abilities and experiences. Because of this wide range of
classroom, or school, or between schools, no attempt is made to
for any learning experiences. Emphasis should be placed upon the
will best prepare students for a life beyond the classroom. Finally,
numbers of beginning teachers, a few of the experienced teachers and
who are unfamiliar or slightly acquainted with the methods and mater-
meaningful time allotments can be established at a later time.

s in this guide depends, in a large part, on the teacher's own resource-
ideas and concepts toward which the experiences are pointed will not
epts and ideas must be set forth and explained. Laboratory procedure
ording and interpretation of data, which, so far as possible, should be
counting, or other types of quantitative determination.

ideas in mind that the committees and teachers have labored to develop
thod of instruction that will both improve and enhance the instructional
y Public Schools. Those teachers who endorse the philosophy, purpose,
this guide will share in the process of meeting the intricate and delicate
hour and subsequently will succeed in strengthening the fabrics of
um of education. This ultimately will lead us toward a better under-
nd point the way toward a peaceful co-existence with it.

Floyd Conard
Daniel Dyman
Lola Lemon

BASIC TEXTBOOKS REFERENCE MATERIALS A

BSCS Committee. Biological Science: An Inquiry Into Life. Chic
1963, 1968 (2nd ed.).

BSCS Committee. Teacher's Manual - Biological Science: An Inqui
Brace and World, 1963, 1968 (2nd ed.).

BSCS Committee. Student Laboratory Guide - Biological Science:
Harcourt, Brace and World, 1963, 1968 (2nd ed.).

BSCS Committee. Teacher's Manual for Student Laboratory Guide -
Into Life. Chicago: Harcourt, Brace and World, 1963, 1968

Brandwein, Paul, Fletcher Watson, and Paul Blackwood. Teaching H
Methods. Chicago: Harcourt, Brace and World, Inc., 1958.

Morholt, Evelyn, Paul Brandwein, and Alexander Joseph. A Sourceb
Chicago: Harcourt, Brace and World, Inc., 1966 (2nd ed.).

Schwab, J. Biology Teachers' Handbook. New York: J. Wiley and

BSCS Committee. Teacher's Guide to Accompany - Biological Scienc
Illinois: Houghton Mifflin Company, 1963.

Process of Science Test. The Psychological Corporation, 304 East
10017; 1962.

BSCS Quarterly Achievement Tests, R or S forms. Harcourt, Brace
Chicago, Illinois, 60648.

BSCS Comprehensive Final Exam, J form. The Psychological Corpora
York, New York, 10017, 1962.

ASIC TEXTBOOKS REFERENCE MATERIALS AND TEACHING AIDS

cience: An Inquiry Into Life. Chicago: Harcourt, Brace and World,

nual - Biological Science: An Inquiry Into Life. Chicago: Harcourt,
968 (2nd ed.).

ratory Guide - Biological Science: An Inquiry Into Life. Chicago:
d, 1963, 1968 (2nd ed.).

nual for Student Laboratory Guide - Biological Science: An Inquiry
rcourt, Brace and World, 1963, 1968 (2nd ed.).

son, and Paul Blackwood. Teaching High School Science: A Book of
ourt, Brace and World, Inc., 1958.

in, and Alexander Joseph. A Sourcebook for the Biological Sciences.
e and World, Inc., 1966 (2nd ed.).

Handbook. New York: J. Wiley and Sons, Inc., 1963.

ide to Accompany - Biological Science: Molecules to Man. Geneva,
lin Company, 1963.

Psychological Corporation, 304 East 45th Street, New York, New York,

sts, R or S forms. Harcourt, Brace and World, 7555 Caldwell Avenue,
.

, J form. The Psychological Corporation, 304 East 45th Street, New
962.

SUPPLEMENTARY TEXT AND REFERE

BSCS Committee. Biological Science: Molecules to Man. Genev
1963, 1968 (2nd ed.).

BSCS Committee. High School Biology. Chicago: Rand McNally

Otto, James H., and Albert Towle. Modern Biology. New York:

Otto, James H., Albert Towle, and Elizabeth H. Crider. Teache
New York: Holt, Rinehart, and Winston, Inc.

UPPLEMENTARY TEXT AND REFERENCE MATERIALS

e: Molecules to Man. Geneva, Illinois: Houghton Mifflin Company,

gy. Chicago: Rand McNally and Company, 1968.

Modern Biology. New York: Holt, Rinehart and Winston, Inc.

lizabeth H. Crider. Teacher's Guide to the Modern Biology Program.
Winston, Inc.

UNIT I

THE HISTORICAL DEVELOPM

UNIT OBJECTIV

1. Acquaint the student with basic facts, common theories, history and the development of biology essential to the u basic ideas of biological inquiry and discovery.

2. Develop an understanding of the principles and basic idea development of biology.

3. Develop the ability of the student to use basic facts, id and development of basic concepts and the seeking of new and the development of biology.

4. Develop the ability of the student to apply facts and pri as such facts and principles relate to the history and de

5. Develop the ability of the student to locate and evaluate information relates to the historical development of biol

6. Develop the ability to reason logically and critically as tory and development of biology.

7. Develop the simple research skills of tabulating, classif preting data.

8. Develop the ability of the student to formulate assumption

9. Develop the skills of accurate observation, reflective anc

10. Develop skills in the use of the microscope, the balance, small equipment.

11. Create and develop within the student an awareness and an that exist between science and society.

12. Stimulate student interest and achievement in reading th activities.

13. Develop skills that will enable the student to function ef planning, group participation and group decisions.

UNIT I

THE HISTORICAL DEVELOPMENT OF BIOLOGY

UNIT OBJECTIVES

h basic facts, common theories, ideas and information pertaining to the
ent of biology essential to the understanding of those principles and
l inquiry and discovery.

of the principles and basic ideas pertaining to the history and

he student to use basic facts, ideas, and principles in the formation
concepts and the seeking of new concepts as they relate to the history
iology.

he student to apply facts and principles to the solution of problems
ples relate to the history and development of biology.

he student to locate and evaluate information from sources as this
he historical development of biology.

eason logically and critically as such reasoning pertains to the his-
biology.

rch skills of tabulating, classifying information, organizing and inter-

he student to formulate assumptions and weigh evidence discriminately.

curate observation, reflective and independent thinking.

e of the microscope, the balance, bunsen burner, glassware, and other

n the student an awareness and an appreciation of the inter-relationships
ce and society.

st and achievement in reading through directed and independent reading

enable the student to function effectively in group thinking, group
ation and group decisions.

UNIT 1: THE HISTORICAL DEVELOPMENT OF BIOLOGY

CONCEPT	CONTENT
1. Biology is a science that is concerned with the study of living organisms and their relationships to their environment.	1. Bios - logos Specialized fields of biology Physical environment Biological environment
2. Many recent discoveries in biology are the result of tools, techniques and efforts of many scientists, both past and present.	2. Antibiotics Malaria DNA Light miscroscope Phase contrast microscope Electron microscope

UNIT 1: THE HISTORICAL DEVELOPMENT OF

SUGGESTED ACTIVITIES	
1. Open-ended discussion. Field trip around school site or immediate community. Balance an aquarium and/or a terrarium. FILMS: Introduction to Biology. B&W, 14 min. Natures' Half Acre. Color. 33 min. This Vital Earth. Color. 10 min. What is Ecology. Color. 10 min. * Processes of Science Test (POST). This test should given to all biology students during the first or second week of school.	1. Brandwein Blackwo Book of World, Morholt, Joseph. (2nd ed Inc., 1 Standen, York: * The Psych New Yor
2. Open-ended discussion. Laboratory investigations: 1-1, 3-1, 3-2, 3-9. Invitation to Inquiry 10. FILMS: Debt to the Past. Color. 16 min. Louis Pasteur. B&W. 30 min. What is Science. B&W. 10 min. Weighing & Measuring - Techniques 1 and 2 (8 mm). Color, 4 min.	2. BSCS Comm Laborato Inquiry and Wor Schwab, J J. Wiley Conant, Ja Experime Harvard Gabriel, M Biology Prentice Dubos, R. Boston, Co., 195 Film Libra BSCS Biolo Colorado Ealing Fil 343 N. Cap

UNIT 1: THE HISTORICAL DEVELOPMENT OF BIOLOGY

CTIVITIES	RESOURCE MATERIALS
l site or immediate community. /or a terrarium. . B&W, 14 min. lor. 33 min. r. 10 min. . 10 min.	1. Brandwein, Paul, Fletcher Watson, and Paul Blackwood. Teaching High School Science: A Book of Methods. New York: Harcourt, Brace and World, Inc., 1958. Morholt, Evelyn, Paul Brandwein, and Alexander Joseph. A Sourcebook for the Biological Sciences (2nd ed.). New York: Harcourt, Brace and World, Inc., 1966. Standen, Anthony. Science is a Sacred Cow. New York: E.P. Dutton and Company.
st (POST). This test should dents during the first or	* The Psychological Corporation, 304 East 45th St., New York, New York 10017; 1962.
ns: 1-1, 3-1, 3-2, 3-9. 0.	2. BSCS Committee. Teacher's Manual for Student Laboratory Guide - Biological Science: An Inquiry into Life. New York: Harcourt, Brace and World, 1963. Schwab, J. Biology Teachers' Handbook. New York: J. Wiley and Sons, Inc., 1963. Conant, James. Harvard Case Histories in Experimental Science. Cambridge, Massachusetts: Harvard University Press, 1957. Gabriel, M. and S. Fogel. Great Experiments in Biology. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1955. Dubos, R.J. Louis Pasteur, Free Lance of Science. Boston, Massachusetts: Little, Brown, and Co., 1950.
r. 16 min. min. 10 min. Techniques 1 and 2 (8 mm). Color, 4 min.	Film Library, School Service Center BSCS Biological Technique Series. Boulder, Colorado: Thorne Films, Inc. Ealing Film Loops. Shoemaker Motion Picture Co. 343 N. Capitol, Indianapolis, Indiana 46204.

CONCEPT
3. Progress in related fields of science has resulted in the development of new goals.
4. Scientific investigation requires planned and orderly procedures or methods.
5. Life comes from life and is a product of protoplasm.

UNIT 1: THE HISTORICAL DEVELOPMENT OF BIOLOGY

	CONTENT
fields of science has resulted in ew goals.	3. Biochemistry Biophysics Cytology Bacteriology Genetics
ion requires planned and orderly s.	4. Research method of problem solving Technical method of problem solving
and is a product of protoplasm.	5. Abiogenesis Biogenesis

SUGGESTED ACTIVITIES

3. Open-ended class discussion.
   Speaker from some field of science industry.

   FILMS:
   Biochemistry and Molecular Structure. Color, 22 min.
   Genetic Investigation. Color, 12 min.
   DNA: Molecule of Heredity. Color, 16 min.

   Filmstrips and Transparencies:
   Check individual school's library materials center.

4. Laboratory investigation: 3.
   Invitation to Inquiry 1-2.

   FILMS:
   Science and Superstition. B&W, 10 min.
   Science Study Skills. Color, 11 min.

5. Laboratory investigation: 2-1.

ACTIVITIES	RESOURCE MATERIALS
cussion. eld of science industry.	3. Wald, George. "Innovation in Biology," Scientific American, September , 1958.
cular Structure. Color, 22 min. . Color, 12 min. edity. Color, 16 min. arencies: ol's library materials center.	
tion: 3. 1-2.	4. BSCS Committee. Teacher's Manual for Student Laboratory Guide - Biological Science: Molecules to Man. Geneva, Illinois: Houghton Mifflin Company, 1963, pp. 139. Schwab, J. Biology Teachers Handbook. Interim summary 1, pages 61-63; interim summary 2, pages 90-92. Dobzhansky, T. "Strangler Trees," Scientific American, January, 1954. Scheerer, Martin. "Problem Solving," Scientific American, April, 1963.
tion. B&W, 10 min. Color, 11 min.	Film Library, School Service Center, 620 East 10th Place, Gary, Indiana.
tion: 2-1.	5. Teacher's Manual for Student Laboratory Guide - Biological Science: An Inquiry Into Life.

CONCEPT
6. Organisms are grouped together by scientists because of their similarities of structure.
7. Increasing complexity of structure parallels division of labor.

	CONTENT
scientists because of	6. System of taxonomical nomenclature Survey of the classification of living things
e parallels division	7. Specialization of the cell Division of labor within the cell

6

SUGGESTED ACTIVITIES	
6. Open-ended discussion Observations with the use of the microscope. FILM: Animals without Backbone. Color. 11 min.	6
7. Open-ended discussion. Develop laboratory exercise with students to coincide with discussion, using the microscope as a basic instrument.	7.

	RESOURCE MATERIALS
microscope. 11 min.	6. Preserved Specimen. Buchsbaum, Ralph. Animals without Backbone. Chicago: University of Chicago, 1948. Hansen, Earl. Animal Diversity. Foundation of Modern Biology Series. New York: Prentice-Hall, 1964.
students to coin- oscope as a basic	7. Baserga, Renato and Walter Kisieleski. "Autobiographies of Cells," Scientific American, August, 1963. Brachet, Jean and A.E. Mirsky. Cell: Biochemistry, Physiology, Morphology, Volume I. New York: Academic Press, 1959. Brandwein, Paul, Fletcher Watson, and Paul Blackwood. Teaching High School Science: A Book of Methods. Morholt, Evelyn, Paul Brandwein, and Alexander Joseph. A Sourcebook for the Biological Sciences. Schwab, J. Biology Teachers' Handbook.

UNIT 2

UNITY OF PATTERNS O

UNIT OBJ

1. Acquaint the student with basic facts, common theor similarities of form and structure of living organi
2. Develop an understanding of the similarities of for
3. Develop the ability of the student to apply facts problems which are real or become real in the setti
4. Develop the ability of the student to locate and form and function of living things.
5. Develop the skill of critical thinking through pro
6. Develop the psychomotor skills through the use of s procedures relative to the study of the unity of fo
7. Develop the ability to collect, organize, analyze, the unity of form and function of living things.
8. Develop the communicative skills in science by buil library, magazine and newspaper research as they re
9. Develop certain social skills that will enable the in group situations.
10. Develop the ability of the student to work with vari
11. Inculcate in the mind of the student an awareness o develop adequate safety techniques and procedures.
12. Instill in the student the need for a neat and order activities involved in individual and group demonstr
13. Develop other laboratory skills such as glass bendin techniques, doing simple dissecting, centrifuging, s of the offering and the student's interests and need
14. Develop the mathematical skills essential as tools i scientific data, and solving scientific problems.
15. Develop other scientific skills as the needs may reve
16. Develop attitudes and appreciations through the buil field of biology.

UNIT 2

UNITY OF PATTERNS OF LIVING THINGS

UNIT OBJECTIVES

sic facts, common theories, ideas and information pertaining to the
ucture of living organisms.

the similarities of form and function of living things.

student to apply facts, concepts and principles to the solution of
ecome real in the setting in which they are presented.

student to locate and evaluate information pertaining to the unity of
things.

al thinking through problem-solving.

ls through the use of scientific equipment, supplies, techniques and
tudy of the unity of form and function of living things.

ct, organize, analyze, and evaluate information and evidence relative to
on of living things.

ills in science by building vocabularies, verbal and written expression,
per research as they relate to science.

s that will enable the student to function cooperatively and effectively

tudent to work with various types of scientific equipment.

student an awareness of the hazards in the laboratory and the need to
niques and procedures.

eed for a neat and orderly arrangement of equipment, supplies, and
idual and group demonstrations, experimentations, and explorations.

lls such as glass bending, heating liquids, using microscopes, sterilizing
secting, centrifuging, staining, and others as they apply to the nature
ent's interests and needs.

lls essential as tools in the field of biology for measuring, manipulating
scientific problems.

lls as the needs may reveal themselves from time to time.

iations through the buildup of favorable experiences and impressions in the

UNIT 2: UNITY OF PATTERNS OF LIVING THINGS

CONCEPT	CONTENT
1. All living organisms are composed of cells, which are the basic units of structure and function.	1. Cell discovery Robert Hooke Theodor Schwann Matthias Schleiden Robert Brown
2. Specialization of the protoplasm within the cell enables it to form various living structures of the cell.	2. Cell theory Plant and animal cell structures Similarities and differences
3. Cytoplasm contains various organized bodies which perform specific functions.	3. Cell membrane Endoplasmic reticulum Ribosome Mitochondria Vacuole Aster Centrosome Spindle fibers Centriole Chloroplast Cell wall Golgi bodies
4. The nucleus is the control center of cellular activity.	4. Nuclear membrane Nucleoplasm - DNA Nucleoli - RNA

SUGGESTED ACTIVITIES	
1. Open-ended discussion. Laboratory investigations 3-3. 3-4. 3-5. 3-6. Transparency: Cell Structure.	1.
2. Open-ended discussion. Development of charts identifying cellular animal and plant characteristics.	2.
3. Study of various models. Development of bulletin board display. Student reports of cell organelles (descriptive).	3.
4. Invitation of Inquiry 1-1 and 1-2. FILM An Inquiry - The Importance of the Nucleus. Color, Super 8mm.	4. Harc

UNIT 2: UNITY OF PATTERNS OF LIVING THINGS

D ACTIVITIES	RESOURCE MATERIALS
. ions 3-3. 3-4. 3-5. 3-6. ructure.	1. Teacher's Manual for Student Laboratory Guide - Biological Science: An Inquiry Into Life. Pfeiffer, J. Cell. Life Science Library Series Park Ridge, Illinois: Silver Burdett, 1964. Overhead projection transparency to accompany Biological Science: An Inquiry into Life. Gabriel and Fogel (eds.) Great Experiments in Biology. Englewood Cliff, New Jersey: Prentice-Hall, Inc. 1955. Brandwein, Paul, Fletcher Watson, and Paul Blackwood. Teaching High School Science: A Book of Methods. Morholt, Evelyn, Paul Brandwein, and Alexander Joseph. A Sourcebook for the Biological Sciences.
. identifying cellular animal tics.	2. Borek, E. The Atoms Within Us. New York: Columbia University Press, 1962.
ls. in board display. ll organelles (descriptive).	3. Swanson, C. The Cell. Foundations of Modern Biology Series. Englewood Cliffs, New Jersey: Prentice-Hall, Inc. 1964. Butler, H. J. Inside the Living Cell. New York: Basic Books 1959. Overhead projection transparency to accompany Biological Science: An Inquiry Into Life.
1-1 and 1-2.	4. Schwab, J. Biology Teachers' Handbook. Brachet, J. "The Living Cell", Scientific American, September, 1964.
ce of the Nucleus. Color, Super	Harcourt Brace and World Inc., Chicago, Ill.

UNIT 2: UNITY OF PATTERNS OF LIVING THINGS

CONCEPT	CONTENT
5. Cells are capable of self-duplication.	5. Mitosis Centrosomes Centrioles Chromatin Chromosome Centromere
6. Scientific investigation and technology provided the means by which knowledge was gained that led to the Cell Theory, and other knowledge pertaining to the cell.	6. Janssen brothers - Microscope Leeuwenhock - Microscope Robert Koch - Koch's postulates Virchow - Staining technique Phase contrast microscope Electron microscope
7. Biological function is chemical in nature and cannot be understood without some knowledge of chemistry.	7. Mechanism Vitalism
8. Elements are composed of atoms which themselves are composed of sub-atomic particles.	8. Phlogiston Theory Dalton and the Atomic Theory

SUGGESTED ACTIVITIES

5. Study of mitotic division models.

   Transparency: Mitosis.

   FILMS:
   Mitosis. Color. 23 min.
   Smear and Squash Technique 1 and 2. 8 mm.
   Mitosis. Color. Super 8mm.

6. Open-ended discussion and student reports.

   Laboratory investigation 3-9.

7. Open-ended discussion.

   Laboratory investigation 14.

8. Open-ended discussion.

   Periodic Table of Elements.

   FILMS:
   A is for Atom. Color. 16 min.
   Chemical Bonding. Color. 16 min. (continued-next page)

UNIT 2: UNITY OF PATTERNS OF LIVING THINGS

TIVITIES	RESOURCE MATERIALS
dels.	5. Morholt, Evelyn, Paul Brandwein, and Alexander Joseph. A Sourcebook for the Biological Sciences Overhead projection transparency to accompany Biological Science: An Inquiry Into Life. 1964.
and 2. 8 mm.	Film Library, School Service Center. BSCS Biological Techinque Series. Boulder, Colorado. Thorne Film, Inc. 1966.
	Harcourt Brace and World, Inc. Chicago, Ill. Ealing, 343 N. Capitol, Indianapolis, Ind. 46204
udent reports.	6. Schwab, J. Biology Teachers' Handbook. Teacher's Manual for Biological Science: An Inquiry into Life.
.	7. Fraenkel-Conrat, H. "Rebuilding a Virus," Scientific American, June, 1956. Duveen, D. "Lavoisier," Scientific American, May, 1956. Wilson, M. "Priestly," Scientific American, October, 1954. Teacher's Manual for Biological Science: Molecules to Man.
	8. Hoffman, K. Chemistry of Life. Scholastic Book Services, New York: 1964. Allen, G. and J. Baker. Matter, Energy, and Life. Reading, Mass: Addison-Wesley, Inc. 1965 Chapters 1-3. White, E. Chemical Background for the Biological Sciences: Foundation of Modern Biology Series, 1964.
min. (continued-next page)	Film Library, School Service Center.

UNIT 2: UNITY OF PATTERNS OF LIVING THINGS

CONCEPT	CONTENT
8. Elements are composed of atoms which themselves are composed of sub-atomic particles.	8. Phlogiston Theory Dalton and the Atomic Theory
9. Matter is anything that has weight and occupies space.	9. Law of Conservation of Mass
0. Protoplasm is composed of 18 different elements suspended as ions and molecules in a colloidal solution.	10. Colloid (gel) Solution Mixture Suspension
1. Compounds are formed when two or more elements share or transfer electrons to or with another.	11. Covalent bonding Ionic bonding

SUGGESTED ACTIVITIES

8. (Continued)
   Our Friend the Atom. Part I-II. Color. 25 min.
   Evidence for Molecules and Atoms. Color. 19 min.
   Living with the Atom. Color. 27 min.
   Molecular Theory of Matter. B&W. 10 min.
   Molecular Motions. Color. 13 min.
   Elements, Compounds, and Mixtures. Color. 28 min.
   Biochemical and Molecular Structure. Color. 22 min.

   FILMSTRIP: Check school's library reference-materials center.

   Transparency: Atoms and Molecules.

9. Demonstration of the Law of Conservation of Matter: Mixing Sodium chromate ($NaCrO_7$) with Silver Nitrate ($AgNO_3$).

   Transparency: Weighing and measuring techniques 1 and 2.

10. Demonstrate the conductivity of salt solutions in a colloid.

11. Demonstrate the formation of iron sulfide from iron, sulfur and heat.

    Demonstrate the formation of crystalline sodium chloride from hydrochloric acid and sodium hydroxide.

TIES	RESOURCE MATERIALS
I. Color. 25 min. oms. Color. 19 min. 27 min. &W. 10 min. min. ures. Color. 28 min. ucture. Color. 22 min.	8. Film Library, School Service Center.
brary reference-materials	
cules.	Overhead projection transparency to accompany Biological Science: An Inquiry into Life.
onservation of Matter: $_7$) with Silver Nitrate easuring techniques 1 and 2.	9. Joseph, A. and others. Teaching High School Science: A Sourcebook for the Physical Sciences. New York: Harcourt, Brace, and World, 1961. Overhead projection transparency to accompany Biological Science: An Inquiry into Life.
of salt solutions in a	10. Joseph, A. and others. Teaching High School Science: A Sourcebook for the Physical Sciences.
iron sulfide from iron, crystalline sodium chloride odium hydroxide.	11. Joseph,A. and others. Teaching High School Science: A Sourcebook for the Physical Sciences.

UNIT 2: UNITY OF PATTERNS OF LIVING THINGS

CONCEPT	CONTE
12. Water molecules in protoplasm are ionized to produce hydrogen and hydrogen ions.	12. Acid Base Salt Ionization
13. All the processes of living cells involve energy transformation provided for by chemical activities within the cell.	13. Conservation of energy Kinetic energy Potential energy Oxidation Reduction
14. Protoplasm has the unique ability to build organic compounds from inorganic matter.	14. Carbohydrates Fats Protein Nucleic acids
15. Enzymes play an important part in the chemical activities of the cell.	15. Catalysts Nature of enzymes Properties of enzymes Co-enzymes Substrate

SUGGESTED ACTIVITIES

12. Laboratory investigation 5-1.
    Laboratory investigation 12 .

    Demonstrate the formation of crystalline $NaCl$ from HCl + $NaCl$.

    Transparency: Ph scale $NaCl$ from HCl + $NaOH$.

13. Demonstrate: Potential vs kinetic energy.

    Laboratory investigation 18.
    Laboratory investigation 6-2.

14. Open-ended discussion.

    Laboratory investigation 6-3.

15. Open-ended discussion.

    Laboratory investigations 6-4 and 6-5.

    Transparency: Enzyme Action.

2:   UNITY OF PATTERNS OF LIVING THINGS

	RESOURCE MATERIALS
	12. *Teacher's Manual for Student Laboratory Guide - Biological Science: An Inquiry Into Life.*
stalline $NaCl$ from	Teacher's Manual for *Biological Science: Molecules to Man.*
m $HCl + NaOH$.	
energy,	13. Joseph, A. and others. *Teaching High School Science: A Sourcebook for the Physical Sciences.* *Teacher's Manual for Student Laboratory Guide - Biological Science: An Inquiry Into Life.* Teacher's Manual for *Biological Science: Molecules to Man.*
	14. Harrow, B. and A. Mazur. *Textbook of Biochemistry* (8th ed.). Philadelphia: W. B. Saunders Company, 1962. Schwab, J. *Biology Teachers' Handbook.* *Teacher's Manual for Student Laboratory Guide - Biological Science: An Inquiry Into Life.*
nd 6-5.	15. *Teacher's Manual for Student Laboratory Guide - Biological Science: An Inquiry Into Life.* Harrow, B. and A. Mazur. *Textbook of Biochemistry.* Schwab, J. *Biology Teachers' Handbook.* Overhead projection transparencies to accompany *Biological Science: An Inquiry into Life.*

UNIT 2: UNITY OF PATTERNS OF LIVING THINGS

CONCEPT	CONTEN
16. Processes of life are based upon energy-yielding activities within the cell.	16. Exothermic reaction Endothermic reaction Fermentation Glycolysis Kreb cycle
17. The ultimate source of all energy is the sun.	17. Oil Coal Photosynthesis
18. Living things maintain an intricate balance in the presence of constantly changing conditions, externally and internally.	18. Diffusion Active transport
19. Several factors affect the rate at which molecules move across the cell membrane.	19. Molecular concentration Temperature Diffusion pressure

SUGGESTED ACTIVITIES	RESO
16. Laboratory investigation 6-6.	16. Pauling, L. W. H. Fr Noller, C. Pa.: N. Allen, G. Reading, Weisz, P. McGraw Hi Teacher's M Biologica Schwab, J.
17. Open-ended discussion. FILMS: Life from the Sun. Color. 15 min . Sun's Energy. Color. 16½ min. The Fossil Story. (Shell Oil)	17. Rosenberg, and Winst Shell Oil C Illinois.
18. Laboratory investigations 6-1 and 6-2 Laboratory investigation 18.	18. Giese, A. Company, Teacher's Ma Biologica Teacher's Ma Man.
19. Open-ended discussion.	19. Solomon, A. December, Holter, H. " American,

UNIT 2: UNITY OF PATTERNS OF LIVING THINGS

ES	RESOURCE MATERIALS
	16. Pauling, L. General Chemistry. San Francisco, Calif.: W. H. Freeman and Company, 1953. Noller, C. Textbook of Organic Chemistry. Philadelphia, Pa.: N. B. Saunders Company, 1958. Allen, G. and J. Baker. Matter, Energy, and Life. Reading, Mass: Addison-Wesley, Inc., 1965. Weisz, P. The Science of Biology (2nd ed.). New York: McGraw Hill and Company, 1963. Teacher's Manual for Student Laboratory Guide - Biological Science: An Inquiry Into Life. Schwab, J. Biology Teachers' Handbook
in .	17. Rosenberg, J. Photosynthesis. New York: Holt, Rinehart, and Winston, Inc. 1956. Shell Oil Company, 624 S. Michigan Ave., Chicago 5, Illinois. (Free loan use)
and 6-2	18. Giese, A. Cell Physiology. Phil. Pa.: W. B. Saunders Company, 1964. Teacher's Manual for Student Laboratory Guide - Biological Science: An Inquiry Into Life. Teacher's Manual for Biological Science: Molecules to Man.
	19. Solomon, A. "Pores In The Cell," Scientific American, December, 1960. Holter, H. "How Things Get Into Cells," Scientific American, September 1961.

UNIT 2: UNITY OF PATTERNS O

CONCEPT	
20. Cells possess specialized structures that assist in conducting the combined functions of the cell.	20
21. Metabolism is the sum-total of all physico-bio-chemical activities of the cell, which involve both constructive and destructive processes.	21
22. Cellular energy is derived from the breaking of chemical bonds in complex molecules.	22.

UNITY OF PATTERNS OF LIVING THINGS

	CONTENT
hat assist in he cell.	20. Cell wall Cell membrane Endoplasmic reticulum Mitotic apparatus Ribosomes Nucleus Vacuoles Mitochondria Golgi bodies Chloroplasts
sico-bio-chemical both construc-	21. Anabolism: protein synthesis (ribosome) Photosynthesis Catabolism: respiration - digestion
eaking of chem-	22. ATP → ADP + P (18,000 cal.)

SUGGESTED ACTIVITIES	
20. Open-ended discussion Student reports on the activities of cellular organelles. Transparency: Modern Cell.	20. Mo Ov
21. Lecture - discussion.	21. St Le S Sie A
22. Open-ended discussion. Laboratory Investigation 19.	22. Jos S S Tea M

	RESOURCE MATERIALS
	20. Mossonas, A. "How Cells Associate," Scientific American, September, 1961. Overhead projection transparency to accompany *Biological Science: An Inquiry Into Life*.
	21. Stumph, P. "ATP" Scientific American, April, 1953. Lehninges, A. "Energy Transformation in the Cell," Scientific American, September, 1961. Siekevitz, P. "Powerhouse of the Cell," Scientific American, July, 1957.
	22. Joseph, A. and others. *Teaching High School Science: A Sourcebook for the Physical Sciences*. pp. 278-282. Teacher's Manual for *Biological Science: Molecules to Man*.

CONCEPT
23. Oxidation is a vital chemical process of plants and animals and no living organisms can exist without carrying out some form of oxidation.
24. The breakdown of molecules and the release of chemical energy in the cell occur during respiration.
25. Energy released in a cell during respiration is used for synthesis of cellular compounds.
26. A cell may divide because of the critical relationship between the volume of cell content and the surface exposure of the plasma membrane.
27. Chromosomes are bearers of hereditary characteristics.

UNIT 2: UNITY OF PATTERNS OF LIVING THINGS

	CONTENT
rocess of plants and can exist without ation.	23. Oxidation-reduction Fuel + oxidizing agent→fuel fragments + energy ($C_6H_{12}O_6 + 6O_2 + 6H_2O \rightarrow 6CO_2 + 12H_2O$ + energy)
the release of chemical respiration.	24. $C_6H_{12}O_6 + 6O_2 + 6H_2O \longrightarrow 6CO_2 + 12H_2O + 38$ ATP
g respiration is used unds.	25. Amino acids + energy→protein + water
e critical relationship tent and the surface e.	26. Area: $A = 4\pi r^2$ (sphere) $A = e^2$ (cube) Volume: $V = \frac{4\pi r^3}{3}$ (sphere) $V = e^3$ (cube)
ditary characteristics.	27. Genes DNA

SUGGESTED ACTIVITIES	
28. Open-ended discussion. FILMS: Mitosis. Color. 23 min. Smear and Squash technique 1 and 2 (8mm)	28
29. Observation of mitosis of prepared slides of white-fish eggs and onion root tip slides. FILM: Meiosis, Sex Cell Formation. Color. 16 min. Transparency: Meiosis.	29
30. Open-ended discussion Construction of mitotic models Small group activities	30.
31. Make a study of the specialization and differentiation of a chicken egg.	31.
32. Field trip to the Deep River Outdoor Education Center. Study state game laws. FILM: The Rival World. Color. 27 min. Shell Oil Co.	32.

UNITY OF PATTERNS OF LIVING THINGS

	RESOURCE MATERIALS
2 (8mm)	28. Teacher's Manual for Student Laboratory Guide - Biological Science: An Inquiry Into Life. BSCS Biological Techniques Series: Thorne Film, Inc. Boulder, Colorado. Ealing, 343 N. Capitol, Indianapolis, Ind. 46204
ed slides of white- des.	29. Mazia, D. "Cell Division". Scientific American, August, 1953.
lor. 16 min.	Film Library, School Service Center, 620 E. 10th
	Overhead projection transparencies to accompany Biological Sciences: An Inquiry Into Life.
	30. Mazia, D. "Cell Division," Scientific American, August, 1953.
on and differentiation	31. Waddington, C. H., "How Do Cells Differentiate," Scientific American, September, 1953.
door Education Center.	32. Resource Unit, Deep River Outdoor Education Program. "Earth Science and Field Biology." Federal Projects office, 620 E. 10th Place. Gary, Indiana.
Shell Oil Co.	Shell Oil Company, 624 S. Michigan Ave. Chicago, Illinois (Free Loan).

UNIT 2: UNITY OF PATTERNS OF LIVING THINGS

CONCEPT	CONTENT
32. All organisms are dependent upon their environment for survival.	32. Biological environment Physical environment
33. Animals and plants are a part of an ecological system, which are units of the biosphere in which living and non-living things interact.	33. Species Communities Biomes
34. In an ecosystem, changes in biotic and abiotic conditions result in changes in the type of communities.	34. Succession Climax community

SUGGESTED ACTIVITIES	
28. Open-ended discussion. FILMS: Mitosis. Color. 23 min. Smear and Squash technique 1 and 2 (8mm)	28. Teache Biol BSCS E Boul Ealing
29. Observation of mitosis of prepared slides of whitefish eggs and onion root tip slides. FILM: Meiosis, Sex Cell Formation. Color. 16 min. Transparency: Meiosis.	29. Mazia, Augu Film L Overhe Biol
30. Open-ended discussion Construction of mitotic models Small group activities	30. Mazia, Augu
31. Make a study of the specialization and differentiation of a chicken egg.	31. Waddin Scier
32. Field trip to the Deep River Outdoor Education Center. Study state game laws. FILM: The Rival World. Color. 27 min. Shell Oil Co.	32. Resourc Progr Feder Gary, Shell C Chica

	RESOURCE MATERIALS
	28. *Teacher's Manual for Student Laboratory Guide - Biological Science: An Inquiry Into Life.* BSCS Biological Techniques Series: Thorne Film, Inc. Boulder, Colorado.
(8mm)	Ealing, 343 N. Capitol, Indianapolis, Ind. 46204
slides of white- s.	29. Mazia, D. "Cell Division". Scientific American, August, 1953.
r. 16 min.	Film Library, School Service Center, 620 E. 10th
	Overhead projection transparencies to accompany *Biological Sciences: An Inquiry Into Life.*
	30. Mazia, D. "Cell Division," Scientific American, August, 1953.
and differentiation	31. Waddington, C. H., "How Do Cells Differentiate," Scientific American, September, 1953.
oor Education Center.	32. Resource Unit, Deep River Outdoor Education Program. "Earth Science and Field Biology." Federal Projects office, 620 E. 10th Place. Gary, Indiana.
hell Oil Co.	Shell Oil Company, 624 S. Michigan Ave. Chicago, Illinois (Free Loan).

UNIT 2: UNITY OF PATTERNS OF LIVING THINGS

CONCEPT	CONTENT
32. All organisms are dependent upon their environment for survival.	32. Biological environment Physical environment
33. Animals and plants are a part of an ecological system, which are units of the biosphere in which living and non-living things interact.	33. Species Communities Biomes
34. In an ecosystem, changes in biotic and abiotic conditions result in changes in the type of communities.	34. Succession Climax community

SUGGESTED ACTIVITIES	
32. Grassland Biome, Color. 15 min. The High Artic Biome. Color, 22 min. The Physical Enviroment. Color. 11 min. The Vanishing Prairie. Color 14 min. Part I. " " 14 min. Part II. " " 12 min. Part III. " " 12 min. Part IV. Prairies and Deciduous Forests. Color. Super 8mm.	32. Film Li Harcour
33. Open-ended discussion. Field trip to Deep River Outdoor Education Center. FILMS: Population Ecology. Color. 19 min. The Bird Community. Color. 12 min. The Cave Community Color. 13 min. The Community. Color. 11 min. The Desert Community. 11 min.	33. Resourc Progra Film Li
34. Open-ended discussion. Field trip to Deep River Outdoor Education Center. FILMS: The Changing Forest. Color. 18 min. The Desert. Color. 20 min. Succession: From Sand Dune to Forest. Color. 16 min. The Temperate Deciduous Forest. Color. 16. min. Tropical Rain Forest. Color. 15 min. Water and Desert Animals. Color. Super 8mm. Water and Desert Plants. Color. Super 8mm.	34. Resourc Progra Film Lib Harcourt

CTIVITIES	RESOURCE MATERIALS
15 min. olor, 22 min. Color. 11 min. Color 14 min. Part I. " 14 min. Part II. " 12 min. Part III. " 12 min. Part IV.	32. Film Library, School Service Center.
orests. Color. Super 8mm.	Harcourt, Brace and World, Inc., Chicago, Ill.
Outdoor Education Center.	33. Resource Unit, Deep River Outdoor Education Program.
r. 19 min. r. 12 min. r. 13 min. min. min.	Film Library, School Service Center.
Outdoor Education Center.	34. Resource Unit, Deep River Outdoor Education Program.
lor. 18 min. n. ne to Forest. Color. 16 min. Forest. Color. 16. min. lor. 15 min.	Film Library, School Service Center.
. Color. Super 8mm. Color. Super 8mm.	Harcourt, Brace and World, Inc., Chicago, Ill.

UNIT 2: UNITY OF PATTERNS OF LIVI

CONCEPT	
35. The transfer of energy and matter in an ecosystem is achieved through cycles.	35.
36. Man's survival is dependent upon his wise use of his resources.	36.

NITY OF PATTERNS OF LIVING THINGS

	CONTENT
an ecosystem is	35. Water cycle Phosphorus cycle Carbon-hydrogen-oxygen Nitrogen cycle
wise use of his	36. Air Pollution Water Pollution Waste Disposal (Radioactive and Human) Soil Conservation Wildlife Management Food Human Resources

SUGGESTED ACTIVITIES	RE
35. Open-ended discussion. Laboratory investigation 8-1. FILMS: Nitrogen Cycle. Color. 18 min. Nitrogen and Living Things. Color. 13½ min. The Rival World. Color. 27 min. (Shell Oil Co.) Transparency: Nitrogen Cycle.	35. Teacher's Ma Biological Film Librar Shell Oil Co Overhead pro Biologica
36. Open-ended discussion. Laboratory investigation 8-1. Visit by a forest ranger, naturalist, state or county conservation officer. Collection and analysis of air, water, and soil. Analysis and study of the extent of air and water pollution, local, state and national. Study of the effects industrial waste has upon aquatic organisms. Study food waste in the home, in the national government, world population. Visit to Deep River Outdoor Education Center. Study local industrial water demands and consumption. FILMS: Meaning of Conservation. Color. 11 min. This Vital Earth. Color. 10 min. Wise Use of Water Resources. Color. 13½ min. Yours Is The Land. Color. 20 min. Food or Famine. Color. 25 min.	36. Haagen-Smit, Scientific Teacher's Ma Biological Life Nature Peter Farb U.S.Governme Soil Conse That Land Agricultur Soil Erosi Making La Know Your Facts Abou Dust Storm Soil and Wat Chicago, I Clean Air an E. I. DeNe Morholt, Eve Joseph. A Brandwein,P. American Bio American Bio Film Librar

	RESOURCE MATERIALS
	35. Teacher's Manual for Student Laboratory Guide - Biological Science: An Inquiry Into Life.
	Film Library, School Service Center.
)	Shell Oil Co. 624 S. Michigan Ave.Chicago,Ill.
	Overhead projection transparency to accompany Biological Science: An Inquiry Into Life.
	36. Haagen-Smit, A.J. The Control of Air Pollution. Scientific American. January, 1964.
	Teacher's Manual for Student Laboratory Guide - Biological Science: An Inquiry Into Life.
	Life Nature Library series, Ecology Peter Farb and Life editors
county	U.S.Government Pamphlets: Soil Conservation at Home
.	That Land Down There Agricultural Land Resources
er pollu-	Soil Erosion: The Work of Uncontrollable Water Making Land Produce Useful Wild Life Know Your Soil
aquatic	Facts About Wind Erosion and Dust Storms on the Great Plains
overnment,	Soil and Water Conservation. 180 N. Michigan Ave. Chicago, Illinois.
	Clean Air and Water in a Complex Society. DuPont, E. I. DeNemours & Co., Wilmington, Delaware
mption.	Morholt, Evelyn, Paul Brandwein, and Alexander Joseph. A Sourcebook for the Biological Sciences.
	Brandwein,P.and others. A Book of Methods
	American Biology Teacher, May,1965..
	American Biology Teacher, May, 1966.
	Film Library, School Service Center.

UNIT 2: UNITY OF PATTERNS OF LIVING THINGS

CONCEPT	CONTENT
37. The most stable and extensive areas of man's environment occupy 70% of the earth's surface.	37. Oceans Lakes Rivers Plankton Primary consumers Secondary consumers
38. Man is in constant competition with himself and other organisms within his environment for survival.	38. Population growth Food distribution Health and disease

SUGGESTED ACTIVITIES	RESOU
37. Open-ended discussion. Laboratory investigations 39-1, 39-2 Field trip to Deep River Outdoor Education Center. FILMS: Life in the Ocean. Color. 10 min. Science of the Sea. Color. 19 min Food Getting Among Animals. Color. 12 min.	37. Stover, J. New York, Powers, C. a Scientifi Resource Un Teacher's Ma Biologica Film Library
38. Open-ended discussion. FILM: Population Ecology. Color. 19 min. 1st Quarterly Achievement Test (R or S Form)	38. Lamont, C. " April, 195 Deevey, E. " American, S Huxley, J. " March, 195 Film Library, Harcourt Bra

UNIT 2: UNITY OF PATTERNS OF LIVING THINGS

IES	RESOURCE MATERIALS
-1, 39-2 door Education Center.) min.) min 'olor, 12 min.	37. Stover, J. The Web of Life. New American Library New York, 1956. Powers, C. and Robertson, A., "The Aging Great Lakes," Scientific American, November, 1966. Resource Unit, Deep River Outdoor Education Program Teacher's Manual for Student Laboratory Guide - Biological Science: An Inquiry Into Life. Film Library, School Service Center.
) min. t (R or S Form)	38. Lamont, C. "The Ecosphere," Scientific American, April, 1958. Deevey, E. "The Human Population," Scientific American, September, 1960. Huxley, J. "World Population," Scientific American, March, 1956. Film Library, School Service Center Harcourt Brace and World. Chicago, Illinois.

UNIT 3

DIVERSITY OF STRUCTURE AND FUNCTION

UNIT OBJECTIVES

1. Acquaint the student with the basic facts, common theories, current ide
to the diversity of structure and function of living organisms.
2. Develop an understanding of the similarities and differences in the st
organisms and problems related to those similarities and differences.
3. Develop the essential skills that will enable the student to apply fact
solution of problems pertaining to the diversity of structure and funct
relevant to daily living.
4. Develop the ability of the student to reason logically and critically,
tains to the diversity of structure and function of living organisms.
5. Develop the communicative skills by developing vocabulary, verbal and w
azine, and newspaper research as they relate to science.
6. Develop those social skills that will enable the student to function co
individual and group situations.
7. Develop the psychomotor skills that will enable the student to master th
supplies, techniques and procedures relative to the study of the diversi
organisms.
8. Develop in the student's mind an awareness of the hazards in the biolog
use adequate safety techniques and procedures.
9. Instill in the student's mind the need for neat and orderly arrangement
activities involved in group and individual demonstration, experimentati
10. Teach for the mastery of laboratory skills such as glass bending, heatin
sterilizing techniques, dissecting, centrifuging, and others as they may
offering and the student's interest and needs.
11. Teach for the mastery of mathematical skills essential as tools in biolo
scientific data, and solving scientific problems.
12. Teach for the mastery of other scientific skills as the needs may revea
13. Develop attitudes and appreciations through the successive buildup of fa
sions in the field of biology.

UNIT 3

DIVERSITY OF STRUCTURE AND FUNCTION

UNIT OBJECTIVES

asic facts, common theories, current ideas and information that pertain
nd function of living organisms.

similarities and differences in the structure and function of living
to those similarities and differences.

at will enable the student to apply facts, concepts and principles to the
to the diversity of structure and function of living organisms that are

ent to reason logically and critically, through problem solving as it per-
ture and function of living organisms.

s by developing vocabulary, verbal and written expressions, library, mag-
s they relate to science.

t will enable the student to function cooperatively and effectively in
.

that will enable the student to master the use of scientific equipment,
ures relative to the study of the diversity of structure and function of

n awareness of the hazards in the biology laboratory and the need to
and procedures.

he need for neat and orderly arrangement of equipment, supplies, and
d individual demonstration, experimentation, and exploration.

tory skills such as glass bending, heating liquids, using microscopes,
ing, centrifuging, and others as they may apply to the nature of the
rest and needs.

atical skills essential as tools in biology for measuring, manipulating
entific problems.

scientific skills as the needs may reveal themselves from time to time.

ions through the successive buildup of favorable experiences and impres-

UNIT 3: DIVERSITY OF STRUCTURE AND FUNCTION

CONCEPT	CONTENT
1. Viruses are noncellular organisms that are smaller than the smallest cells but larger than molecules.	1. History of virus Types Size Shape Characteristics
2. Viruses link the living and nonliving. They contain DNA or RNA, but cannot reproduce outside a living cell.	2. Internal structure External structure Method of reproduction
3. The virulence of a virus may depend on the environment in which it is growing.	3. Host Food supply

SUGGESTED ACTIVITIES	RESO
1. Laboratory investigation 15-1. Note: Laboratory investigation requiring the student to handle viral innoculents is not recommended since it requires precise technique and thorough familiarity with aseptic technique. Transparency: Phage Life Cycle.	1. Teacher's Ma Biological Otto, J., A. gations. N Inc., 1965 Horne, R. "Th American, Lwoff, A. "Th American, Overhead pro Biological
2. Open-ended discussion. Transparency: Phage Life Cycle. Invitation to Inquiry 5. FILM: Viruses: The Threshold of Life. Color. 13½ min.	2. Weidel, W. Vi Press, 1959 Frankel-Conra American, Overhead proj Biological Schwab, J. Bi J. Wiley & Film Library,
3. Student Library Research. Class reports. Invitation to Inquiry 6.	3. Library. Schwab, J. Bio Teacher's Man Biological

ACTIVITIES	RESOURCE MATERIALS
5-1. ition requiring the student to ents is not recommended since technique and thorough famili- echnique. ycle.	1. Teacher's Manual for Student Laboratory Guide - Biological Science: An Inquiry Into Life. Otto, J., A. Towle and E. Crider, Biology Investigations. New York: Holt, Rinehart and Winston, Inc., 1965 Horne, R. "The Structure of Viruses," Scientific American, January 1963 Lwoff, A. "The Life Cycle of a Virus," Scientific American, March 1954 Overhead projection transparency to accompany Biological Science: An Inquiry Into Life.
cle. fe. Color. 13½ min.	2. Weidel, W. Virus. Ann Arbor: University of Michigan Press, 1959 Frankel-Conrat. "Rebuilding a Virus," Scientific American, June 1956 Overhead projection transparency to accompany Biological Science: An Inquiry Into Life. Schwab, J. Biology Teachers' Handbook. New York: J. Wiley & Sons, Inc., 1963 Film Library, School Service Center
	3. Library. Schwab, J. Biology Teachers' Handbook Teacher's Manual for Student Laboratory Guide - Biological Science: An Inquiry Into Life.

UNIT 3: DIVERSITY OF STRUCTURE AND FUNCTION

CONCEPT	CONTEN
4. A viral infection generally results in the alternation of normal metabolic processes within the cells.	4. Lytic cycle Leukemia Polio Phage DNA Tumors
5. Bacteria are the most abundant forms of life.	5. Distribution of bacteria
6. Bacteria are primitive, cellular organisms and are classified according to their shapes, methods of reproduction and staining reactions.	6. Cocci Bacilli Spirilla Spirocheta Spore Formation Gram-positive Gram-negative

SUGGESTED ACTIVITIES	
4. Student Library Research. Sending letters of request to various agencies requesting information concerning the relationship between birds and disease. Invitation to Inquiry 7. Transparency: Phage Life Cycle.	4. Luria, S Americ Nationa New Yo U.S. Dep Govern Schwab, Overhead Scienc
5. Laboratory investigations 9-1, 9-2, 10-2, 16-3. FILMS: Bacteria. Color. 19 min. Bacteriological Techniques. (8 mm)	5. Teacher's Biolog Otto,J., gations BSCS Bio Film Lib
6. Observation of bacterial forms and basic Gram's test. Laboratory investigation 10-1. Laboratory investigations 16-1, 16-4. Invitation 16. Gram test. FILM: Bacteriological Techniques - 8mm.	6. Teacher's Biologi Otto, J., gations Morholt,E for the Marowitz, America Clayton, Scienti Schwab, J. BSCS Biol Ealing, 34

ERSITY OF STRUCTURE AND FUNCTION

	RESOURCE MATERIALS
s requesting n birds and	4. Luria, S. "The T_2 Mystery," Scientific American, April 1952. National Audubon Society, 1130 Fifth Avenue New York, N.Y. 10028. U.S. Dept of Agriculture, Supt.of Documents, Government Printing Office.Wash. D.C.20402 Schwab, J. Biology Teachers' Handbook Overhead transparency to accompany Biological Science: An Inquiry Into Life.
	5. Teacher's Manual for Student Laboratory Guide - Biological Science: An Inquiry Into Life. Otto,J., A. Towle and E. Crider. Biology Investigations. BSCS Biological Techniques Series. Film Library, School Service Center
s test.	6. Teacher's Manual for Student Laboratory Guide - Biological Science: An Inquiry Into Life. Otto, J., A. Towle and E. Crider. Biology Investigations. Morholt,E.,P.Brandwin,and A. Joseph. A Sourcebook for the Biological Sciences. Marowitz, H. "The Smallest Living Cells," Scientific American, March, 1962 Clayton, R.and N.Delbruck,"Purple bacteria," Scientific American, Nov. 1951 Schwab, J., Biology Teachers' Handbook. BSCS Biological Techniques Series. Ealing, 343 N. Capitol, Indianapolis, Ind. 47404

CONCEPT	CONT
7. Certain bacteria undergo change of form as a means of protection against adverse environmental conditions.	7. Endospore
8. Some bacteria are harmful, while many are beneficial.	8. Parasitic-pathogenic Non-pathogenic Saprophytic Soil bacteria
9. Koch's postulates are methods of inquiry for the identification of pathogens.	9. Koch's postulates

SUGGESTED ACTIVITIES	RESOURCE
7. Microscopic observation of bacterial endospores.	7. Hotchkiss, R. "T American, Novem
8. Laboratory investigations 8-1, 11-3, 11-4, 11-5. Discuss and/or visit milk industries, etc. Invite a speaker from one of the various industries. Transparency: Effects of Antibiotics on Bacteria.	8. Teacher's Manual Biological Sci Overhead projec Biological Sc
9. Open-ended discussion.	9. Simon, H. "Microbe National Science D.C. 1963.

TIVITIES	RESOURCE MATERIALS
cterial endospores.	7. Hotchkiss, R. "Transformed Bacteria," Scientific American, November, 1956
, 11-3, 11-4, 11-5.	8. Teacher's Manual for Student Laboratory Guide - Biological Science: An Inquiry Into Life.
ustries, etc.	
he various industries.	
biotics on Bacteria.	Overhead projection transparency to accompany Biological Science: An Inquiry Into Life.
	9. Simon, H. "Microbes and Men," Vistas of Science, National Science Teachers' Association, Wash. D.C. 1963.

CONCEPT	CONTENT
10. Infectious organisms are spread in many ways.	10. Contact Wind Food Water Animal vectors Water droplet
11. For each disease caused by an organism a specific microbe exists.	11. Communicable Contagious
12. The human body possesses structural and chemical defenses against diseases.	12. Skin Lymph nodes W.B.C's Antibodies Antigens

SUGGESTED ACTIVITIES	
10. Open-ended discussion. Laboratory investigation 10-2. Tour area around school and in the neighborhood. Make survey of unsanitary conditions.	10. Tea B
11. Open-ended discussion. Invite speakers from the City Board of Health. Visit the City Board of Health.	11. Yoe S
12. Open-ended discussion. Laboratory investigation 11-1. FILM The Senses of Man. Color. 18 min.	12. Wood Sc Teac Bi Film

UNIT 3: DIVERSITY OF STRUCTURE AND FUNCTION

CTIVITIES	RESOURCE MATERIALS
, n the neighborhood. ditions.	10. Teacher's Manual for Student Laboratory Guide - Biological Science: An Inquiry Into Life.
Board of Health. n.	11. Yoeli, M. "Animal Infections and Human Disease," Scientific American, May, 1960.
in.	12. Wood, Jr., B. "White Blood Cells vs. Bacteria," Scientific American, February, 1951 Teacher's Manual for Student Laboratory Guide - Biological Science: An Inquiry Into Life. Film Library, School Service Center.

CONCEPT	CONTEN
13. An organism may possess immunity against certain diseases.	13. Natural immunity Acquired immunity
14. Large numbers of spores may be produced by fungi and distributed over vast geographical areas.	14. Black bread mold Wind Water
15. Many common fungi such as molds, yeast, mildew, and mushrooms require certain conditions for survival.	15. Food Moisture Warmth Darkness

SUGGESTED ACTIVITIES

13. Open-ended discussion.

14. Laboratory investigation 19-1.

15. Laboratory investigation 12-1.
Culturing Bread Mold.
Invitation 6-7.

FILMS:
Life of Molds. Color. 23 min.
Neurospora Techniques 1 and 2 (8mm).

TIES	RESOURCE MATERIALS
	13. Burnet, M. "The Mechanism of Immunity," Scientific American, January, 1958.
	14. Otto, J., A. Towle and E. Crider. Biology Investigations.
n).	15. Teacher's Manual for Student Laboratory Guide - Biological Science: An Inquiry Into Life. Morholt, E., P. Brandwein, and A. Joseph. A Sourcebook for the Biological Sciences. Schwab, J. Biology Teachers' Handbook. Film Library, School Service Center. BSCS Biological Techniques Series. Thorne Films.

CONCEPT	CONTENT
16. Some fungi are of great economic importance to man.	16. Food industry Wine industry Baking industry Medicine
17. Algae are widely distributed and vary from unicellular organisms to multicellular organisms over a hundred feet long.	17. Land Water Air Blue green algae Green algae Red algae Brown algae
18. Algae are considered to be autotrophs.	18. Chlorophyll Producers

SUGGESTED ACTIVITIES

16. Laboratory investigation 19.

Laboratory investigation 7-1.

Visit to Deep River Outdoor Education Center.

17. Laboratory investigation 13-1.

Laboratory investigations 20-1, 20-2.

18. FILMS:
Simple Plants: Algae. Color. 17 min.
Simple Plants: Algae and Fungi. Color. 13 min.

16. Te
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17. Tea
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18. Fil

IES	RESOURCE MATERIALS
ion Center.	16. Teacher's Manual for Biological Science: Molecules to Man. Emerson, R. "Molds and Men," Scientific American, January, 1952. Gregory, William H. Biological Science for High School. Resource Unit, Deep River Outdoor Education Program.
-2.	17. Teacher's Manual for Student Laboratory Guide - Biological Science: An Inquiry Into Life. Otto, J., A. Towle and E. Crider. Biology Investigations.
n. lor. 13 min.	18. Film Library, School Service Center.

UNIT 3: DIVERSITY OF STRUCTURE AND FUNCTION

CONCEPT	CONTENT
19. Algae conduct varied methods of sexual and asexual reproduction.	19. Spore Isogamy Gamete Heterogamy
20. The reproductive process of alternation of generations is a trend toward complexity of structure and function.	20. Sporophyte Gameophyte
21. Algae have great potential for use during space flights and as food to help relieve famine in the world.	21. Space travel: Food Supply Carbon-Hydrogen-Oxygen Cycle

SUGGESTED ACTIVITIES	
19. Open-ended discussion. Microscopic study of algae reproductive methods (if slides available.	19. Morh Sc
20. Microscopic study of algae reproductive methods (if slides available.)	20. Mori A
21. Library - research: population explosion vs. food supply. Write to NASA for information pertaining to the problem of food in space.	21. Weis Am Miln Am

T 3: DIVERSITY OF STRUCTURE AND FUNCTION

ES	RESOURCE MATERIALS
ive methods (if	19. Morholt,E., P. Brandwein, and A. Joseph. A Sourcebook for the Biological Sciences.
ive methods (if	20. Morholt, E., P. Brandwein, and A. Joseph. A Sourcebook for the Biological Sciences.
sion vs. food supply. ning to the problem	21. Weiss, F. "The Useful Algae," Scientific American, December, 1952. Milner, H. "Algae as Food," Scientific American, October, 1953.

UNIT 3: DIVERSITY OF STRUCTURE AND FUNCTION

CONCEPT	CONTE
22. Bryophytes are land plants that are restricted to moist environments.	22. Rhizoids Non-vascular tissue
23. Ferns are tracheophytes because they have conducting vessels.	23. Vascular tissue
24. Bryophytes and ferns are dependent on water through which the sperm must travel to fertilize the egg.	24. Life cycle of the moss Life cycle of the fern

SUGGESTED ACTIVITIES	RE
22. Laboratory investigation 21-1. Microscopic study of prepared slides of moss structure. Growing moss in a terrarium. (Alternation of generation as indicated by concept 20. May also be studied here with Laboratory investigation 14-1). Visit to the Deep River Outdoor Education Center. FILMS: Origin of Land Plants: Liverworts and Mosses. Color. 13 min. Culturing Slime Mold Plasmodium #1 & #2 (8mm)	22. Otto, J., Investi Teacher's Biologi Film Libr BSCS Biol
23. Laboratory investigation 14-2. Microscopic study of prepared fern slides. FILM: The Evolution of the Vascular Plant. Color. 16 min.	23. Teacher's Biologic Film Libra
24. Laboratory investigations 14-2, 21-1.	24. Otto, J., Investig Teacher's Biologic

UNIT 3: DIVERSITY OF STRUCTURE AND FUNCTION

TIVITIES	RESOURCE MATERIALS
slides of moss structure.	22. Otto, J., A. Towle and E. Crider. Biology Investigations. Teacher's Manual for Student Laboratory Guide - Biological Science: An Inquiry Into Life.
indicated by concept 20. Laboratory investigation	
r Education Center.	
rts and Mosses.Color. 13 min.	Film Library Center, School Service Center.
m #1 & #2 (8mm)	BSCS Biological Techniques Series, Boulder,Colo.
	23. Teacher's Manual for Student Laboratory Guide - Biological Science: An Inquiry Into Life.
fern slides.	
Plant. Color. 16 min.	Film Library, School Service Center.
21-1.	24. Otto, J., A. Towle and E. Crider. Biology Investigations. Teacher's Manual for Student Laboratory Guide - Biological Science: An Inquiry Into Life.

UNIT 3: DIVERSITY OF STRUCTURE AND FUNCTION

CONCEPT	CONTENT
25. The parts of plants that contain chlorophyll carry on photosynthesis.	25. Leaf Stem
26. Chlorophyll captures light energy for the reactions involved in photosynthesis.	26. Chlorophyll molecule Light phase reaction Dark phase reaction
27. Living organisms depend directly or indirectly on photosynthesis for food.	27. Food web

SUGGESTED ACTIVITIES	R
25. Laboratory investigations15-5, 16-1. Transparency: Stomatal apparatus and physiology.	25. Teacher's Biolog Overhead Biolog
26. Laboratory investigations 15-1, 15-2, 15-3. Transparency: Photosynthesis. FILMS: Photosynthesis. Color. 21 min. How Green Plants Make Food: Photosynthesis. Color. 13½ min. Phototropism, Color. Super 8mm.	26. Teacher's Biolog Overbeck, Vistas Hoffman, Scienc Overhead Biolog Film Lib Harcourt
27. Open-ended discussion. Web of life in a microaquarium.	27. Morholt, A Sour p. 229.

ACTIVITIES	RESOURCE MATERIALS
5-5, 16-1. aratus and physiology.	25. Teacher's Manual for Student Laboratory Guide - Biological Science: An Inquiry Into Life. Overhead projection transparency to accompany Biological Science: An Inquiry Into Life.
15-1, 15-2, 15-3. is. min. : Photosynthesis. Color. 13½ min. 8mm.	26. Teacher's Manual for Student Laboratory Guide - Biological Science: An Inquiry Into Life. Overbeck, J. "The Lore of Living Plants," Vistas of Science #8, Wash. D.C. N.S.T.A 1964 Hoffman, K. "The Chemistry of Life," Vistas of Science #7 Wash. D.C. N.S.T.A. 1965 Overhead projection transparency to accompany Biological Science: An Inquiry Into Life. Film Library, School Service Center. Harcourt Brace and World, Inc., Chicago, Illinois
arium,	27. Morholt, E., P. Brandwein, and A. Joseph. A Sourcebook for the Biological Sciences. p. 229.

UNIT 3: DIVERSITY OF STRUCTURE AND FUNCTION

CONCEPT	CONTENT
8. The stem is an organ of support and conduction for the plant.	28. Herbacious stem Woody stem Conducting tissue
9. Roots function as organs of anchorage, absorption and food storage for the plant.	29. Tap root Fibrous root Root hairs Cortex
0. The roots and stems of monocots and dicots differ in structure.	30. Arrangement of vascular bundles Absence of cambium

SUGGESTED ACTIVITIES	R
28. Laboratory investigations 16-1, 16-2, 16-3. Microscopic study of prepared slides and wet mount slides. (Smear and Squash technique). Study of a cross-section of a woody stem, e.g. tree trunk. Field trip to the Deep River Outdoor Education Center. FILMS: Smear and Squash technique #1 and #2	28. Teacher Biolo Morhol Sour pp 2 BSCS Bi Ealing,
29. Laboratory investigation 24-2.	29. Otto, J Inves
30. Laboratory investigation 23-1. Class discussion of root types. Grow carrots, radishes, grasses etc. in class to illustrate various types of roots.	30. Otto, J. Invest

UNIT 3: DIVERSITY OF STRUCTURE AND FUNCTION

VITIES	RESOURCE MATERIALS
, 16-2, 16-3. slides and wet mount nnique). woody stem, e.g. tree trunk. utdoor Education Center. and #2	28. Teacher's Manual for Student Laboratory Guide - Biological Science: An Inquiry Into Life. Morholt, E., P. Brandwein, and A. Joseph. A Sourcebook for the Biological Sciences. pp 296-299. BSCS Biological Technique Series, Thorne films Ealing, 343 N. Capitol, Indianapolis, Indiana
	29. Otto, J., A. Towle and E. Crider. Biology Investigations.
. s etc. in class to ots,	30. Otto, J., A. Towle and E. Crider. Biology Investigations.

UNIT 3: DIVERSITY OF STRUCTURE AND FUNCTION

CONCEPT	CONTEN
31. Stems and roots increase in length and size due to the activity of certain cells within the plant.	31. Meristem Vascular cambium
32. Variations in flower structure may adapt them for pollen transfer.	32. Self pollination Cross pollination
33. A seed is an immature sporophyte protected by one or more coats or layers.	33. Embryo Endosperm Seed coat

SUGGESTED ACTIVITIES	
31. Microscope study of monocot and dicot roots and stems.	31
32. Laboratory investigation 17-1. Field trip to the Deep River Outdoor Education Center. Transparency: Life Cycle of Flowering Plants.	32.
33. Laboratory investigation 17-2, FILMS: Angiosperms: The Flowering Plants. Color. 15 min. Seed Plants: The Diversity and Adaptation. Color. 11 min. *BSCS Second Quarterly Achievement Test - Form R or S.	33.

	RESOURCE MATERIALS
t roots and stems.	31. *Teacher's Manual for Student Laboratory Guide - Biological Science: An Inquiry Into Life.*
	32. *Teacher's Manual for Student Laboratory Guide - Biological Science: An Inquiry Into Life.*
Education Center.	
ng Plants.	Overhead projection transparency to accompany *Biological Science: An Inquiry Into Life.*
	33. *Teacher's Manual for Student Laboratory Guide - Biological Science: An Inquiry Into Life.*
Color. 15 min.	Naylor, A. "The Control of Flowering," Scientific American, May, 1952.
tation. Color. 11 min.	Film Library, School Service Center.
Test - Form R or S.	Harcourt, Brace & World, Inc.

UNIT 3: DIVERSITY OF STRUCTURE AND FUNCTION

CONCEPT	CONTEN
34. Various means are employed by plants for seed dispersal	34. Wind Water Animal
35. Seed germination is dependent upon several factors.	35. Temperature Moisture Oxygen
36. Growing plants respond to various stimuli.	36. Light Gravity Chemical Water

SUGGESTED ACTIVITIES	
34. Open-ended discussion. Field trip to the Deep River Outdoor Education Center. Examination of various fruits and the mechanism of seed transportation.	34. Fiel
35. Laboratory investigation 26-5. FILM: Growth of Plants. Color. 20 min.	35. Ott In
36. Laboratory investigation 17-4. Transparency: Effects of Auxin. FILMS: Plant Tropisms and Other Movements. Color. 11 min. Reactions in Plants and Animals. B&W. 10 min. Phototropism. Color. Super 8mm.	36. Teac Bi Over pa Li Film Harc

DIVERSITY OF STRUCTURE AND FUNCTION

	RESOURCE MATERIALS
	34. Field study
Education Center. mechanism of seed	
	35. Otto, J., A. Towle and E. Crider. Biology Investigations.
	36. Teacher's Manual for Student Laboratory Guide - Biological Science: An Inquiry Into Life. Overhead projection for transparency to accompany Biological Sciences: An Inquiry Into Life.
Color. 11 min. . 10 min.	Film Library, School Service Center.
	Harcourt Brace and World, Chicago, Illinois

UNIT 3: DIVERSITY OF STRUCTURE AND FUNCTION

CONCEPT	CONTENT
37. The basic life processes are performed by unicellular and multicellular organisms.	37. Digestion Transportation Respiration Excretion Coordination Support and locomotion Reproduction Development
38. Food is a substance which is used by tissues for energy, growth, repair and regulation.	38. Carbohydrates Fats Proteins Minerals Vitamins Water
39. Digestion is the process which converts complex food molecules into simpler ones.	39. Mechanical process Chemical process

SUGGESTED ACTIVITIES	RES
37. Open ended discussion. Laboratory investigations19-2, 3, 4, 5, 6, 20-4. Transparency: Cell Matabolism, Parameciam, Conjugation, Hydra, Planarian, Earth Worm, Grasshopper, Human Body. FILMS: Protozoa: Structure and Life Function. Color. 16 min. Animals Unlimited. Color. 19 min. Flatworms: Platyhelminthes. Color. 16 min. Earthworm Anatomy. Color. 11 min.	37. Teacher's Biologi Overhead Biologi Film Libr
38. Laboratory investigation 21-1. FILMS: Digestive System. Color. 17 min. Digestion of Food. B&W. 10 min.	38. Teacher' Biolog Film Libr Otto, Jam Modern Winston
39. Open-ended discussion. FILM: Our Mr. Sun. Color. 60 min.	39. Otto, Jame Modern B Illinois 416 West

: DIVERSITY OF STRUCTURE AND FUNCTION

	RESOURCE MATERIALS
5, 6, 20-4. ecium, Conjugation, pper, Human Body.	37. Teacher's Manual for Student Laboratory Guide - Biological Science: An Inquiry Into Life. Overhead projection transparency to accompany Biological Sciences: An Inquiry Into Life.
n. Color. 16 min. min.	Film Library, School Service Center.
	38. Teacher's Manual for Student Laboratory Guide - Biological Science: An Inquiry Into Life. Film Library, School Service Center Otto, James H., Albert Towle, Elizabeth H. Crider. Modern Biology. New York: Holt, Rinehart and Winston, Inc. 1965.
	39. Otto, James H., Albert Towle, Elizabeth H. Crider. Modern Biology. Illinois Bell Telephone Company (Free loan) 416 West 5th Avenue, Gary, Ind.

UNIT 3: DIVERSITY OF STRUCTURE AND FUNCTION

CONCEPT	CONTENT
40. Each phase of digestion in multicellular animals occurs outside the cells and is regulated by a specific hydrolytic enzyme.	40. Carbohydrate digestion Protein digestion Fat Digestion
41. Tiny structures in the digestive tract function as absorption agents for the end products of digestion.	41. Duodenum Villi
42. Multicellular animals require a transport system to insure the circulation of materials.	42. Diffusion Active transport Circulatory system Lymphatic system

SUGGESTED ACTIVITIES	
40. Open-ended discussion. Invitation to Inquiry 12. Laboratory investigation 41-1.	40. Sch Ott C Ott C
41. Open-ended discussion. Slides FILM: Human Body: The Digestive System. Color. 13½ min.	41. Ott C Fil
42. Open-ended discussion. Laboratory investigation 18.	42. Tea Mc

NIT 3: DIVERSITY OF STRUCTURE AND FUNCTION

IES	RESOURCE MATERIALS
	40. Schwab, J. Biology Teachers' Handbook Otto, James H., Albert Towle, Elizabeth H. Crider. Modern Biology. Otto, James H., Albert Towle, Elizabeth H. Crider. Teacher's Guide to the Modern Biology Program. New York: Holt, Rinehart and Winston, Inc. 1965.
	41. Otto, James H., Albert Towle, Elizabeth H. Crider. Modern Biology,
. Color. 13½ min.	Film Library, School Service Center.
	42. Teacher's Manual for Biological Science: Molecules to Man.

CONCEPT	CONTENT
43. The circulatory system of some multicellular animals differ in structure.	43. Open circulatory system Closed circulatory system
44. The heart is a highly efficient pump having two phases in its cycle and is responsible for circulating blood through an organism.	44. Heart Arteries Arterioles Capillaries Venules Veins
45. Blood is a type of connective tissue.	45. Plasma Red blood cells White blood cells Protein substances Lymph

SUGGESTED ACTIVITIES

43. Laboratory investigations 22-1, 22-2.

Transparency: Earthworm, Grasshopper, The Human Body.

44. Transparency: The Human Body.

FILMS:
How Your Blood Circulates. B&W 28 min.
Story of the Blood Stream. Part 1. Color. 29 min.
Story of the Blood Stream. Part 2. Color. 24 min.

45. Microscopic study of blood smear slides.

Transparency: The Human Body.

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UNIT 3: DIVERSITY OF STRUCTURE AND FUNCTION

TIVITIES	RESOURCE MATERIALS
-1, 22-2. asshopper, The Human Body.	43. Teacher's Manual for Biological Science: Molecules to Man. Overhead transparencies to accompany Biological Science: An Inquiry Into Life. (Teacher's Manual)
.	44. Overhead projection for transparencies to accompany Biological Sciences: An Inquiry Into Life.
&W 28 min. art 1. Color. 29 min. art 2. Color. 24 min.	Film Library, School Service Center.
mear slides. .	45. Surgenor, D. "Blood," Scientific American, February, 1954. Fox, H. "Blood Pigments," Scientific American, March, 1950. Overhead projection transparency to accompany Biological Sciences: An Inquiry Into Life.

CONCEPT

46. Blood transports various substances to and from the body tissues.

47. Blood is grouped according to the presence or absence of certain proteins in the red blood cells.

48. Respiration is the process of getting oxygen to the cell and disposing of carbon dioxide.

NIT 3: DIVERSITY OF STRUCTURE AND FUNCTION

	CONTENT
to and from the	46. Water Inorganic substances Digested foods Hormones Oxygen Carbon dioxide
resence or absence lood cells.	47. O A B AB Rh+ Rh-
ng oxygen to the cells	48. Breathing Transportation of oxygen Glucose oxidation ATP formation Carbon dioxide and water formation Carbon dioxide transportation

SUGGESTED ACTIVITIES

46. FILM:
The Blood. Color. 16 min.

47. Open-ended discussion.

Blood typing. (Samples may possibly be secured from local hospital laboratories.)

FILM:
Hemo The Magnificent. Color. 60 min.

48. Laboratory investigation 23-1.

Open-ended discussion.

Transparency: The Human Body.

UNIT 3: DIVERSITY OF STRUCTURE AND FUNCTION

VITIES	RESOURCE MATERIALS
	46. Film Library, School Service Center.
ssibly be secured from	47. Wiener, S. "Parentage and Blood Groups," Scientific American, July, 1954.
0 min.	Illinois Bell Telephone Co, 416 W. 5th Ave. Gary, Ind. (free loan)
	48. *Teacher's Manual for Student Laboratory Guide - Biological Science: An Inquiry Into Life.* Overhead projection transparency to accompany *Biological Science: An Inquiry Into Life.*

UNIT 3: DIVERSITY OF STRUCTURE AND FUNCTION

CONCEPT	CONTENT
49. Two factors greatly influence the rate of respiration.	49. Nervous system Adrenalin
50. Special structures function in higher multicellular animals to eliminate some of the by-products of respiration.	50. Kidneys Water Nitrogeneous waste
51. Other special structures function as organs of excretion.	51. Skin Lungs Liver

SUGGESTED ACTIVITIES

49. Open-ended discussion.

Invitation to Inquiry 38, 41, 42.

FILMS:
Breathing. Color. 28 min.
Rescue Breathing. Color. 21 min.

50. Laboratory investigation 24-1.

Open-ended discussion.

51. Open-ended discussion.

FILM:
The Senses of Man. Color. 18 min.
Human Body: The Respiratory System. Color. 13½ min.

NIT 3: DIVERSITY OF STRUCTURE AND FUNCTION

ES	RESOURCE MATERIALS
	49. Fenn,W. "The Mechanism of Breathing." Scientific American, January, 1960 Lehninger, A. "How Cells Transform Energy," Scientific American, September, 1961. Lehninger, A. "Energy Transformation in Cells," Scientific American, May, 1960. Film Library, School Service Center. Illinois Bell Telephone Co. 416 W. 5th Ave. Gary, Indiana
	50. Teacher's Manual for Student Laboratory Guide - Biological Science: An Inquiry Into Life. Smith, H. "The Kidney." Scientific American. December, 1953.
Color, 13½ min.	51. Best, C.H. and N.E. Taylor. The Human Body: The Anatomy and Physiology. 4th ed. New York: Holt, Rinehart and Winston, 1963. Film Library, School Service Center.

UNIT 3: DIVERSITY OF STRUCTURE AND FUNCTION

CONCEPT	CONTENT
52. Body homeostasis is affected by several systems working in unity.	52. Digestive system Transport system Respiratory system Excutory system
53. Higher, complex organisms possess a complex communication network through which it coordinates and regulates body activities.	53. Neuroses Synapse Central nervous system Peripheral nervous system Autonomic nervous system
54. The endocrine glands system secrete chemical substances that assist in coordinating and regulating body activities.	54. Pineal gland Pituitary gland Thyroid gland Para thyroid gland Islets of langerhanus Testes Ovaries

SUGGESTED ACTIVITIES

52. Invitation to Inquiry 38, 41, 42.

FILM:
Human Machine. B&W. 14 min.

53. Laboratory investigation 25-1.

Laboratory investigations 44-1, 2, 3, 4.

FILMS:
Exploring The Human Nervous System. Color. 23 min.
Fundamentals of The Nervous System. Color. 16 min.
The Human Body: Sense Organs. Color. 18½ min.
Gate Ways to The Mind. Color. 60 min.

54. Open-ended discussion.

Laboratory investigation 27-1.

Invitation to Inquiry 41,43.

UNIT 3: DIVERSITY OF STRUCTURE AND FUNCTION

TIVITIES	RESOURCE MATERIALS
1, 42.	52. D'Armour, F. Basic Physiology. Chicago: Univ. of Chicago Press, 1962. Schwab, J. Biology Teachers' Handbook. Film Library, School Service Center.
-1. 4-1, 2, 3, 4. System. Color. 23 min. System. Color. 16 min. . Color. 18½ min. . 60 min.	53. Teacher's Manual for Student Laboratory Guide - Biological Science: An Inquiry Into Life. Otto, J., A. Towle and E. Crider. Biology Investigations. Film Library, School Service Center. Illinois Bell Telephone Co.416 W. 5th Ave.Gary.
1.	54. Teacher's Manual for Student Laboratory Guide - Biological Science: An Inquiry Into Life. Burnet, M. "The Thymus Gland," Scientific American, November, 1962. Wilkins, L. "The Thyroid Gland," Scientific American, March, 1960. Li Choh Hao, "The Pituitary," Scientific American, October 1950.

UNIT 3: DIVERSITY OF STRUCTURE AND FUNCTION

CONCEPT	CONTENT
55. The ability of higher, more complex organisms to move is closely tied to the type of skeleton.	55. Exoskeleton Endoskeleton
56. Special contractile tissues are responsible for motion in higher organisms.	56. Skeletal muscles Smooth muscles Cardiac muscles
57. Reproduction is a fundamental biological process that provides for the continuance of life on the earth.	57. Purposes

SUGGESTED ACTIVITIES
55. Laboratory investigations 40-1 (Parts 1, 2, & 3). FILM: The Human Body: The Skeleton. Color. 11 min.
56. Laboratory investigation 40-2 .
57. Laboratory investigation 20-1. FILMS: Human Body: Reproductive System. Color. 13½ min. Human Growth. Color. 19½ min. Reproduction in Sea Urchin. Color. 13½ min. Wonder of Reproduction. Color. 12 min. Miracle of Reproduction. Color. 15 min.

UNIT 3: DIVERSITY OF STRUCTURE AND FUNCTION

TIVITIES	RESOURCE MATERIALS
0-1 (Parts 1, 2, & 3). m. Color. 11 min.	55. Otto, J., A. Towle and E. Crider. Biology Investigations. Film Library, School Service Center.
0-2 .	56. Otto, J., A. Towle and E. Crider. Biology Investigations. Huxley, H. "The Contraction of Muscle." Scientific American. November, 1958.
0-1. System. Color. 13½ min. ch. . Color. 13½ min. olor. 12 min. Color. 15 min.	57. Teacher's Manual for Student Laboratory Guide - Biological Science: An Inquiry Into Life. Film Library, School Service Center.

UNIT 3: DIVERSITY OF STRUCTURE AND FUNCTION

CONCEPT	CONTENT
58. The methods of reproduction are grouped into two categories.	58. Asexual reproduction Sexual reproduction
59. In sexual reproduction two dissimilar gametes unite to form a zygote.	59. External fertilization Internal fertilization
60. In human reproduction the process begins with the union of the egg and sperm, and ends with the offspring.	60. Male reproductive system Female reproductive system Ovulation Fertilization Fetal development Hormonal control Birth

SUGGESTED ACTIVITIES	
58. Open-ended discussion.	58.
59. Open-ended discussion.	59.
60. Laboratory investigations 28-1, 28-2. FILMS: Human Growth. Color. 19½ min. A Quarter Million Teenagers. Color. 16 min. Miracle of Reproduction. Color. 15 min.	60.

UNIT 3: DIVERSITY OF STRUCTURE AND FUNCTION

D ACTIVITIES	RESOURCE MATERIALS
	58. Teacher's Manual for Biological Science: Molecules to Man. BSCS Committee. Teacher's Handbook for Patterns and Process. New York: Holt, Rinehart and Winston, Inc. 1966.
	59. Teacher's Manual for Biological Science: Molecules to Man. BSCS Committee. Teacher's Handbook for Patterns and Process.
s 28-1, 28-2, min. ers, Color. 16 min. Color. 15 min,	60. Teacher's Manual for Student Laboratory Guide - Biological Science: An Inquiry Into Life. Film Library, School Service Center.

CONCEPT	CONTENT
61. Sexual reproduction provides a means of transferring similar traits and characteristics of the parents to the offspring.	61. Chromosomes

SUGGESTED ACTIVITIES

61. Transparency: Meiosis

FILM:
Meiosis Sex Cell Formation. Color. 16 min.

Third Quarterly Achievement Test. Form R or S.

	RESOURCE MATERIALS
	61. Overhead projection transparency to accompany *Biological Science: An Inquiry Into Life*.
6 min.	Film Library, School Service Center.
orm R or S.	Harcourt, Brace and World, Inc.

UNIT 4

CONTINUITY OF LI

UNIT OBJECTIV

1. Acquaint the student with basic facts, common theories,
development and the continuation of life on this planet.

2. Develop an understanding of the relationships that exist
in life.

3. Stress the important roles the biotic and abiotic environ

4. To develop those mental skills that will enable the stud
the solution of problems that are relevant to today's li

5. Develop the ability of the student to locate, synthesize
to the continuity of life.

6. Develop an understanding of the human being and his role

7. Develop an understanding of the relationships that man ho
and physical environment.

8. Stress the impact scientific and technological developme
tural development of man and their present and future ro

9. Develop the ability of the student to reason logically an
tains to the development and perpetuation of life.

10. Develop the communicative skills by building vocabularie
magazine, and newspaper research, as they relate to scien

11. Develop the social skills that will enable the student to
individual and group situations.

12. Develop psychomotor skills that will enable the student t
plies, techniques and procedures as he studies the develop

13. Develop in the student's mind an awareness of the hazard
develop and use adequate safety techniques and procedures

14. Instill in the student the need for a neat and orderly ar
involved in individual and group demonstrations, experime

UNIT 4

CONTINUITY OF LIFE

UNIT OBJECTIVES

cts, common theories, ideas and information pertaining to the history,
f life on this planet.

lationships that exist among the unity, diversity and the continuity

tic and abiotic environments share in the continuation of life.

t will enable the student to apply facts, concepts and principles to
relevant to today's living.

to locate, synthesize and evaluate information and ideas pertaining

man being and his role in the development and perpetuation of life.

ationships that man has to man and his responsibility to his biological

chnological developments have had upon the social, economic, and cul-
present and future role toward the continuation of life.

to reason logically and critically through problem-solving as it per-
tuation of life.

building vocabularies, verbal and written expressions, library,
s they relate to science.

enable the student to function cooperatively and effectively in

l enable the student to master the use of scientific equipment, sup-
he studies the development and the continuation of life.

areness of the hazards in the biology laboratory and the need to
hniques and procedures.

a neat and orderly arrangement of equipment, supplies, and activities
monstrations, experimentations, and explorations.

UNIT 4: CONTINUITY OF

CONCEPT	
1. The branch of biology which is concerned with the heredity and variation of successive generations is called Genetics.	1. Her Var
2. An organism is a product of both heredity and environment.	2. Dros Chlo Ide
3. In the study of heredity or any other scientific problem, the outcome and success of the investigation often depends upon selecting the right experimental materials and using the proper controls.	3. Mend

UNIT 4: CONTINUITY OF LIFE

	CONTENT
concerned with the ssive generations is	1. Heredity Variation
h heredity and	2. Drosophila wing curling Chlorophyll synthesis and light Identical twins
y other scientific ss of the investigation he right experimental controls.	3. Mendel's experiments with garden peas

SUGGESTED ACTIVITIES	
1. Open-ended discussion. FILM: *Thread of Life*.	1. Bonne Pre Illin 416
2. Open-ended discussion. Laboratory investigation 30-5. FILM: *Gene Action*. Color. 18 min.	2. Life Tim Teache Bio Film I
3. Open-ended discussion. FILMS: *Laws of Heredity*. Color. 15 min. *Meiosis, Sex Cell Formation*. Color. 16 min.	3. Morhol A So Film L

UNIT 4: CONTINUITY OF LIFE

RESOURCE MATERIALS

1. Bonner, Don. Heredity. Englewood Cliffs, New Jersey: Prentice-Hall, Inc. 1961.

   Illinois Bell Telephone Co.
   416 W. 5th Avenue, Gary, Indiana (Free Loan)

2. Life Science Library. Evolution. Chicago, Illinois: Time, Inc. 1963.
   Teacher's Manual for Student Laboratory Guide - Biological Science: An Inquiry Into Life.

   Film Library, School Service Center.

3. Morholt, Evelyn, Paul Brandwein, and Alexander Joseph. A Sourcebook for the Biological Sciences.

   Film Library, School Service Center.

16 min.

CONCEPT	CONTENT
4. In the expression of a characteristic, some traits may mask the expression of other traits.	4. Dominant genes Recessive genes Law of Dominance Law of Incomplete Dominance
5. Genes usually exist in pairs.	5. Allele
6. Inherited characteristics are determined by the presence or absence of certain combinations of genes for every trait.	6. Genotype Phenotype Homozygous Heterozygous

SUGGESTED ACTIVITIES	
4. Laboratory investigation 30-2. Problem solving: roan cattle, four-o'clock.	4. *Teache* *Biol* Nirenb Ame
5. Open-ended discussion. FILMS: *Genes in Action*. Color. 18 min. *Law of Heredity*. Color. 15 min.	5. David Ame Film
6. Problem solving: dominant and recessive traits. FILMS: *Genes in Action*. Color. 18 min. *Laws of Heredity*. Color. 15 min. *Meiosis, Sex Cell Formation*. Color. 16 min.	6. Wolfg Sci Film

	RESOURCE MATERIALS
	4. *Teacher's Manual for Student Laboratory Guide - Biological Science: An Inquiry Into Life.* Nirenberg, M., "The Genetic Code: II." Scientific American, March, 1963.
	5. Davidson, Eric. "Hormones and Genes," Scientific American, June, 1965. Film Library, School Service Center.
aits.	6. Wolfgang, B., and C. Ulrich. "Chromosome Puffs," Scientific American, April, 1964. Film Library, School Service Center.
n.	

UNIT 4: CONTINUITY OF LIFE

CONCEPT	CONTENT
7. During cell division the members of each pair of genes usually separate.	7. Law of Segregation
8. Solving genetic problems are similar to solving problems involving chance events.	8. Law of Probability
9. The inheritance of some characteristics may be expressed as a blending.	9. Allele Incomplete dominance

SUGGESTED ACTIVITIES	
7. Open-ended discussion. Transparency: Meiosis. FILMS: Genes in Action. Color. 18 min. Laws of Heredity. Color. 15 min. Meiosis, Sex Cell Formation. Color. 16 min.	7.
8. Laboratory investigation 30-2.	8.
9. Problem solving: incomplete dominance - roan and four-o'clock.	9.

	RESOURCE MATERIALS
	7. Mazia, D. "How Cells Divide," Scientific American, September, 1961. Morholt, Evelyn, Paul Brandwein, and Alexander Joseph. A Sourcebook for the Biological Sciences. Overhead projection transparency to accompany Biological Science: An Inquiry Into Life. Film Library, School Service Center.
or. 16 min.	
	8. Teacher's Manual for Student Laboratory Guide - Biological Science: An Inquiry Into Life.
nance - roan and	9. Otto, James H., Albert Towle, Elizabeth H. Crider. Modern Biology. New York: Holt, Rinehart and Winston, Inc., 1965.

CONCEPT	CONTENT
10. Many characteristics are expressed through the influence of two or more pairs of genes.	10. Multiple alleles Blood types
11. When two or more pairs of genes are considered in genetic problems, they assort themselves independently during the formation of gametes.	11. Law of Independent Assortment Dihybrid crossing
12. Though most problems in heredity evolve around a single characteristic, organisms are a composite of hundreds of different traits.	12. Dihybrid crossing

SUGGESTED ACTIVITIES	
10. Problem solving: blood types.	10. Brandwei Blackwo Book of and Wo Morholt, Joseph. 2nd ed. Inc.,
11. Laboratory investigation 30-2.	11. Teacher's Biologi
12. Problem solving: Dihybrid crossing.	12. Haffner, Xerox C Ohio. 4

RESOURCE MATERIALS

10. Brandwein, Paul, Fletcher Watson, and Paul Blackwood. Teaching High School Science: A Book of Methods. New York: Harcourt, Brace and World, Inc., 1958.

Morholt, Evelyn, Paul Brandwein, and Alexander Joseph. A Sourcebook for the Biological Sciences 2nd ed. New York: Harcourt, Brace and World, Inc., 1966.

11. Teacher's Manual for Student Laboratory Guide - Biological Science: An Inquiry Into Life.

12. Haffner, Rudolph. "Genetics, The Thread of Life," Xerox Corporation, Education-Center, Columbus, Ohio. 43216

CONCEPT	
13. During the formation of gametes, the chromosome number is reduced to one-half of the *original 2n number*.	1
14. During the meiotic process chromosomes generally separate randomly.	14
15. Sex in some organisms is influenced by the presence or absence of certain chromosomes.	15

	CONTENT
some number umber.	13. Meiosis Haploid (monoploid) -n Diploid 2n Polyploid n
erally	14. Independent assortment of chromosomes Walter Sutton
presence	15. X and Y chromosomes Sex chromosomes Autosomes

SUGGESTED ACTIVITIES	
13. Open-ended discussion. Transparency: Meiosis.	13. Morholt, Joseph Overhead Biolog
14. Open-ended discussion. Transparency: Crossing-over During Meiosis.	14. Morholt. Joseph Overhead Biolog
15. Problem solving: Sex determination. Transparency: Crossing-over During Meiosis.	15. Mittwock Scient Overhead Biolog

RESOURCE MATERIALS

13. Morholt, Evelyn, Paul Brandwein, and Alexander Joseph. A Sourcebook for the Biological Sciences.
Overhead projection transparency to accompany Biological Science: An Inquiry Into Life.

14. Morholt, Evelyn, Paul Brandwein, and Alexander Joseph. A Sourcebook for the Biological Sciences.
Overhead projection transparency to accompany Biological Science: An Inquiry Into Life.

15. Mittwock, Ursula, "Sex Differences in Cells," Scientific American, July, 1963.
Overhead projection transparency to accompany Biological Science: An Inquiry Into Life.

CONCEPT	CONTENT
16. Some genetic characteristics are influenced by the sex of the individual.	16. Thomas Morgan Sex linkage Drosophila (white eyes) Baldness Hemophilia Color blindness
17. New combinations of linked genes can occur during mitosis and/or meiosis.	17. Crossing-over Chromosome mapping
18. Occasionally, during the reduction division process, chromatids may not segregate.	18. Nondisjunction C. B. Bridges Human mosaic Mongoloids

SUGGESTED ACTIVITIES

16. Problem solving: Sex linked traits.

17. Open-ended discussion.

Transparency: Crossing-over During Meiosis, Nondisjunction.

18. Open-ended discussion.

Transparency: Nondisjunction.

	RESOURCE MATERIALS
	16. McElroy, William and Swanson, Carl P. Modern Cell Biology. New Jersey: Prentice-Hall, Inc. 1968
osis, Nondisjunc-	17. McElroy, William and Swanson, Carl P. Modern Cell Biology. Overhead projection transparency to accompany Biological Science: An Inquiry Into Life.
	18. Bearn, A. and J. Berman III. "Chromosomes and Disease," Scientific American, November, 1961. Overhead projection transparency to accompany Biological Science: An Inquiry Into Life.

CONCEPT	
19. Genes are composed of large complex chemical molecules known as DNA.	
20. Nucleotides are the building blocks of nucleic acids.	
21. Nucleic acids are very large complex molecules from which RNA and DNA are formed.	2

	CONTENT
	19. Transformed bacteria and pneumococcus F. Griffith M. McLoed O. T. Avery M. McCarty Radioactive labeled virus A. Hershey M. Chase
eic acids.	20. Adenine nucleotide Guanine nucleotide Cytocine nucleotide Thymine nucleotide Uracil nucleotide
cules from	21. Nitrogen base Pyrimidines; cytosine, thymine, uracil Purines; guanine, adenine Sugars: deoxyribose, ribose

SUGGESTED ACTIVITIES	
19. Open-ended discussion. FILM: *DNA-Molecule of Heredity*. Color. 16 min.	19.
20. Open-ended discussion. Transparency: Components of DNA...The Nucleotides.	20.
21. Open-ended discussion. Model building.	21.

	RESOURCE MATERIALS
n.	19. Horowitz, N. "The Gene," Scientific American, October, 1956. Hotchkiss, R. and E. Weiss. "Transformed Bacteria," Scientific American, November, 1956. Benzer, Seymour. "The Fine Structure of the Gene," Scientific American, January, 1962. Film Library, School Service Center.
Nucleotides.	20. McElroy, William and Swanson, Carl P. Modern Cell Biology. Holley, R.W. "The Nucleotide Sequence of a Nucleic Acid," Scientific American, February, 1966. Overhead projection transparency to accompany Biological Science: An Inquiry Into Life.
	21. Crick, F.H.C. "Nucleic Acids," Scientific American, September, 1957.

UNIT 4: CONTINUITY OF LIFE

CONCEPT	CONTENT
22. Various scientific techniques have lead to the discovery of the structure of the DNA molecule.	22. Watson, Crick, Wilkins X-ray studies Biochemical studies
23. In the same species the quantity and quality of DNA remains constant from generation to generation.	23. Replication process M. Meselson and F. W. Stahl
24. Gene activity can be studied by observing embryonic development and biochemical differences.	24. Beadle's and Tatum's studies of Neurospora mutation. One-gene-one-enzyme hypothesis Human idiocy Sickle cell anemia

SUGGESTED ACTIVITIES	
22. Open-ended discussion.	22. Crick, Sept Crick, Mate
23. Open-ended discussion. Transparency: Replication of DNA.	23. Tayl Sci Over Bi
24. Open-ended discussion. Transparency: Relication of DNA: Evidence of DNA. FILM: Genetic Investigations. Color. 12 min.	24. Mirsk Sci Konig Mus Allis Sci Over Bi Gray, Ame Film

RESOURCE MATERIALS

22. Crick, F.H.C. "Nucleic Acids," Scientific American, September, 1957.
    Crick, F.H.C. "The Structure of the Hereditary Material," Scientific American, October, 1954.

23. Taylor, H. "The Duplication of Chromosomes," Scientific American, June, 1958.
    Overhead projection transparency to accompany Biological Science: An Inquiry Into Life.

24. Mirsky, A.E. "The Chemistry of Heredity," Scientific American, February, 1953.
    Konigsberg, Irwin R. "The Embryological Origin of Muscle," Scientific American, August, 1964.
    Allison, Anthony C. "Sickle Cells and Evolution," Scientific American, August, 1957.
    Overhead projection transparency to accompany Biological Science: An Inquiry Into Life.
    Gray, C. "Sickle Cell Anemia," Scientific American, August, 1967.
    Film Library, School Service Center.

ience of DNA.

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UNIT 4: CONTINUITY OF LIFE

CONCEPT	CONTENT
25. Genes express their control over enzymes through protein synthesis.	25. Messenger RNA Transfer RNA Template Ribosomes
26. Genes determine hereditary traits and are portions of DNA molecules.	26. Triplet sequence of nucleotide
27. DNA acts through RNA, which in turn encodes amino acids to synthesize proteins.	27. Transfer RNA Template Ribosomes

SUGGESTED ACTIVITIES	
25. Open-ended discussion. Transparency: Components of DNA...The Nucleotide."	25.
26. Open-ended discussion. FILM: Gene Action. Color. 16 min.	26.
27. Open-ended discussion. Transparency: Protein Synthesis, "Cracking The Code."	27.

UNIT 4: CONTINUITY OF LIFE

	RESOURCE MATERIALS
eotide."	25. Davidson, Eric H. "Hormones and Genes," Scientific American, June, 1965. Hurwitz and Furch. "Messenger RNA," Scientific American, February, 1962. Changeux, Jean. "The Control of Biochemical Reactions," Scientific American, April, 1965. Overhead projection transparency to accompany Biological Science: An Inquiry Into Life.
	26. Crick, F.H.C. "The Genetic Code," Scientific American, October, 1962. Horowitz, Norman H. "The Gene," Scientific American, October, 1958. Film Library, School Service Center.
ng The Code."	27. Nirenberg, Marshall. "The Genetic Code: II," Scientific American, March, 1963. Overhead projection transparency to accompany Biological Science: An Inquiry Into Life.

CONCEPT
28. During cell reproduction the nucleus and the cytoplasm influence each other during the process.
29. Gene frequencies are the basis of population genetics. Since it is impossible for geneticists to know all that should be known about populations, they use models of the selected population.
30. The Hardy-Weinberg Principle is a method used to determine by mathematical calculations, genotypes and phenotypes of a given generation by population sampling.

CONTINUITY OF LIFE

	CONTENT
	28. Acetabularia studies See urchin egg studies
etics. ll models	29. Population model assumption Population sampling - tongue rolling Gene pool
o es ion	30. $p + q = 1$ $(p + q)^2 = 1^2$ $p^2 + 2pq + q^2 = 1$

SUGGESTED ACTIVITIES	
28. Open-ended discussion. Transparency: Evidence of Nuclear Control.	28. Gibor, Ah Scienti Overhead Biologi
29. Open-ended discussion.	29. Stern, C. San Fra
30. Open-ended discussion. Problem solving: PTC tasting, tongue rolling, eye color. Laboratory investigation 33-1.	30. Schefler, Law," Teacher's Biologi

	RESOURCE MATERIALS
ntrol.	28. Gibor, Aharon. "Acetabularia: A Useful Giant Cell," Scientific American, November, 1966. Overhead projection transparency to accompany *Biological Science: An Inquiry Into Life*.
	29. Stern, C. *Principles of Human Genetics*. California: San Francisco. Freeman, 2nd ed. 1960.
e rolling,	30. Schefler, William, "Teaching the Hardy-Weinberg Law," The American Biology Teacher, May, 1968. *Teacher's Manual for Student Laboratory Guide Biological Science: An Inquiry Into Life*.

UNIT 4: CONTINUITY OF LIFE

CONCEPT	CONTENT
31. Influences which act upon a population over a long period of time may change the gene pool and result in the genetic isolation of populations which once were related.	31. Mutation Natural selection Isolation Emigration Immigration
32. The development of genetics has greatly improved the science of selective breeding of plants and animals.	32. Eugenics Artificial selection Pedigrees Hybrid stock-corn, cattle Artificial insemination
33. The application of genetic principles to human inheritance may help man understand the nature of life and seek solutions to some of his most perplexing genetic problems.	33. Artificial insemination RH factor in blood Blood types and grouping Hemophilia Color blindness Baldness Diabetis mellitus Intelligence Feeble-mindness Schizophrenia

SUGGESTED ACTIVITIES
31. Open-ended discussion.
32. Student reports.
33. Laboratory investigation 33-2.

UNIT 4: CONTINUITY OF LIFE

	RESOURCE MATERIALS
	31. Lack, David. "Darwin's Finches," Scientific American, April, 1953. Crow, James F. "Ionizing Radiation and Evolution," Scientific American, September, 1959. Wecker, Stanley. "Habitat Selection," Scientific American, October, 1964.
	32. Library.
	33. Teacher's Manual for Student Laboratory Guide - Biological Science: An Inquiry Into Life.

UNIT 4: CONTINUITY OF LIFE

CONCEPT	CONTENT
34. Evolution is a study of the changes in plant and animal forms that have taken place over long periods of time and the forces that have produced those changes.	34. Ideas about evolution Natural selection Adaptation
35. Some inherited characteristics can be influenced by the environment.	35. Yellow and white fat rabbit Himalayan rabbit
36. Organisms with more suitable inherited characteristics that enable them to adapt to the environment are able to survive from generation to generation.	36. Protective coloration Kangaroo rat Ptarmigans DDT resistant insects Penicillin resistant bacteria

SUGGESTED ACTIVITIES

34. Open-ended discussion.

Laboratory investigation 34-1.

FILMS:
Adaptation of Plants. Color. 17 min.
Adaptation of Plants & Animals. Color. 13 min.
Animal Habitats. Color. 10 min.
Distribution of Plants & Animals. Color. 16 min.

35. Laboratory investigation 34-1.

FILMS:
An Example of the Biological Significance of Color. Color. 8mm.
Color. Color. 8mm.
Mimicry. Color. 8mm.

36. Laboratory investigation 34-2.

FILMS:
Camouflage in Nature Through Form and Color. Color. 10 min.
The Peppered Moth: A Population Study. Color. 8mm.

34. Lif
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Film

35. Teac
Bi

Harc
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36. Teac
Bic

Film
Harc
75

	RESOURCE MATERIALS
. 13 min. or. 16 min.	34. Life Science Library. Evolution, Time, Inc. Chicago, 1963. Simpson, G. The Meaning of Evolution. New Haven: Yale University Press, 1949. Lack, David. "Darwin's Finches," Scientific American, February, 1956. Eiseley, Loren. "Charles Darwin, Scientific American, February, 1956. Dobzhansky, Theodosius, "The Genetic Basis of Evolution," Scientific American, January,1950. Millot, Jacques. "The Coelacanth," Scientific American, December, 1955. Teacher's Manual for Student Laboratory Guide - Biological Science: An Inquiry Into Life. Film Library, School Service Center.
cance of Color.	35. Teacher's Manual for Student Laboratory Guide - Biological Science: An Inquiry Into Life. Harcourt, Brace and World, Inc. 7555 Caldwell Avenue, Chicago,Ill. 60648
nd Color. Color.10 min. dy. Color. 8mm.	36. Teacher!s Manual for Student Laboratory Guide - Biological Science: An Inquiry Into Life. Film Library, School Service Center. Harcourt, Brace and World, Inc. 7555 Caldwell Avenue, Chicago, Ill. 60648

UNIT 4: CONTINUITY OF LIFE

CONCEPT	CONTEN
37. Present and past evidence lend credence to the belief that evolutionary changes in the form and structure of organisms have taken place.	37. Inheritance inbreeding Geographical distribution Fossils Homologies Embryology development Vestigial organs
38. Evolutionary changes are influenced primarily through three major processes.	38. Natural selection Genetic variability Gene pool
39. Mutations, which are genetic alterations, may occur frequently in a population.	39. Gene mutation effects Gene mutation rate

SUGGESTED ACTIVITIES	
37. Open-ended discussion. Display fossils. FILMS: Prehistoric Animals of the Tar Pits. Color. 20 min. The Dinosaur Age. Color. 17 min.	
38. Open-ended discussion. FILM: Natural Selection. Color. 16 min.	3
39. Open-ended discussion.	39

IES	RESOURCE MATERIALS
	37. Morholt, Evelyn, Paul Brandwein, and Alexander Joseph. A Sourcebook for the Biological Sciences.
its. Color. 20 min.	Film Library, School Service Center.
	38. Dobzhansky, T. "The Genetic Basic of Evolution," Scientific American, January, 1950. Linn, Charles. Probability and Statistics. Columbus, Ohio: American Education Publication, Education Center, 1966.
.	Film Library, School Service Center.
	39. Hollander, W. "Lethal Heredity," Scientific American, July, 1952. Knight, C.A. and Frazier, D. "The Mutation of Virus," Scientific American, July, 1955.

CONCEPT	
40. Alterations of the genetic materials may be provided through genetic recombination.	4
41. Gene pools may be altered as a result of population mobility or immobility.	4
42. Distinct species develop when gene pools of a population are isolated from each other.	4

UNIT 4: CONTINUITY OF LIFE

	CONTENT
als may be provided	40. Columbine Johannsen's experiment: selection for size in bean. University of Illinois Agronomists experiment: selection for oil content in corn kernels.
sult of population	41. Migration Isolation Genetic drift
ne pools of a population	42. Geographic barriers Genetic barriers

SUGGESTED ACTIVITIES	
40. Open-ended discussion. Transparency: Crossing-over During Meiosis.	40. M Ov
41. Open-ended discussion.	41. Te Gl Ry
42. Open-ended discussion.	42. Dob S Lac A

	RESOURCE MATERIALS
is.	40. Morholt, Evelyn, Paul Brandwein, and Alexander Joseph. A Sourcebook for the Biological Sciences. Overhead projection transparency to accompany Biological Science: An Inquiry Into Life.
	41. Teacher's Manual for Student Laboratory Guide - Biological Science: Molecules to Man. Glass, B. "The Genetics of the Dunkers," Scientific American, October, 1953. Ryan, F. "Evolution Observed," Scientific American, October, 1953.
	42. Dobzhansky, T. "The Genetic Basis of Evolution," Scientific American, January, 1950. Lack, David. "Darwin's Finches," Scientific American, January, 1950.

UNIT 4: CONTINUITY OF LIFE

CONCEPT	CONTENT
43. Several major ideas attempt to explain the origin and history of life on earth.	43. Life from outer space Special creation Spontaneous generation
44. The primitive earth was probably a cooling mass of molten rock surrounded by gases somewhat different from our present atmospheric gases.	44. Steam Hydrogen Methane Ammonia
45. Several scientists have made investigations into some of the conditions that may have sustained life many years ago.	45. Harold Urey Stanley Miller Sidney Fox Melvin Calvin

SUGGESTED ACTIVITIES	
43. Open-ended discussion.	43. Sh Ga Wa
44. Open-ended discussion.	44, La Bro Fo Gam
45. Open-ended discussion.	45. Gam Joh Mil U "J N

	RESOURCE MATERIALS
	43. Shapely, H. Of Stars and Men. New York: Washington Square Press, 1958. Gabriel, M. and S. Fogel. Great Experiments in Biology. New Jersey: Englewood Cliff, Prentice-Hall, Inc., 1955. Wald, G. "Origin of Life," Scientific American, August, 1954.
	44, Landsberg, H. "The Origin of the Atmosphere," Scientific American, August, 1953. Brown, H. "The Age of the Solar System," Scientific American, April, 1957. Fowler, W. "The Origin of the Ekements," Scientific American, September, 1956. Gamow, G. "The Evolutionary Universe," Scientific American, September, 1956.
	45. Gamow, G. The Creation of the Universe. New York: Mentor Books, New American Library, 1957. Johnson, W. and W. Steere. This is Life: Essays in Modern Biology. New York: Holt, Rinehart and Winston, 1962. Miller, S. L. "Production of Some Organic Compounds Under Possible Primitive Earth Conditions," "Journal of the American Chemical Society." Vol. 77, No. 9, May 12, 1955.

CONCEPT	
46. Fossils of primitive soft-bodied organisms are very rare.	4
47. Some life-forms that lived and died on the earth many years ago are recorded in the geologic history of the earth.	47
48. Recent discoveries seem to indicate structural features of modern man appear to be quite different than those of primitive man.	48.

	CONTENT
ft-bodied organisms are very	46. Fossil remains of blue green algae Iron pyrite deposits Soft-bodied organisms Alterations of sedimentary rocks
ved and died on the earth many in the geologic history of the	47. Geologic time scale Animal life on earth Plant life on earth
to indicate structural features be quite different than those	48. Cro-magnon man Zinjanthropus Australopithecines Java man Peking man Neanderthal man

SUGGESTED ACTIVITIES	
46. Open-ended discussion.	46. Glaess Amer Colber Amer Deevey Amer
47. Open-ended discussions. Visit the Museum of Science and Industry. Visit the Chicago Natural History Museum FILM: Fossils Are Interesting. Color. 10 min.	47. Deevey Scie Eisely, Augu South I Ill. Chicago and L Film Li
48. Open-ended discussion. Visit the Museum of Science and Industry Visit the Chicago Natural History Museum	48. Dunn, L Popul Unive Weckler Ameri South S Rooseve

	RESOURCE MATERIALS
	46. Glaessner, M., "Pre-Cambrian Animals," Scientific American, March, 1961. Colbert, E., "Ancestors of Mammals," Scientific American, February, 1962. Deevey, E., Jr. "Radiocarbon Dating," Scientific American, February, 1962.
stry. seum min.	47. Deevey, E. "Living Records of the Ice Age," Scientific American, May, 1949. Eisely, L. "Charles Lyell," Scientific American, August, 1959. South Lake Shore Drive and 57th St., Chicago, Ill. Chicago Natural History Museum, Roosevelt Road and Lake Shore Drive, Chicago, Ill. Film Library, School Service Center.
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UNIT 4: CONTINUNITY OF LIFE

CONCEPT	CONTENT
49. The culture of man can only be studied by examining artifacts found in association with fossils.	49. Fire pits Tools Paintings Clothes Sacred objects
50. Biology contains a specialized body of knowledge about man and his culture	50. Anthropology Negroid Caucasoid Mongoloid
51. Human beings belong to the same species because they possess the same basic structural features.	51. Body organs Chemical characteristics Interfertility

SUGGESTED ACTIVITIES	
49. Open-ended discussion. Visit the Chicago Natural History Museum.	49. Eis Am MacN i Roos
50. Open-ended discussion. Visit the Oriental Institute of the University of Chicago.	50. Howel Sci Eisel Ame Sahli Ame 1155
51. Open-ended discussion.	51. Coon, 2nd Dobzha York Clark, Amer

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UNIT 4: CONTINUNITY OF

CONCEPT	
52. Through the years man has been able to make the necessary adapations to the environment in an effort to provide for his basic needs and by so doing, developed for himself a culture.	52. Tro Tem Sub A Cer Foo Hun Fis Agr
53. Through the years man has undergone a cultural evolution which is independent of physical changes.	53. Lea Man Coo For

UNIT 4: CONTINUNITY OF LIFE

	CONTENT
make the necessary ffort to provide for loped for himself a	52. Tropical Southern Asia Temperate Southwestern Asia Subtropical or temperate Mexico and Central America Central Andes of South America Food gathering Hunting Fishing Agriculture
cultural evolution ges.	53. Learning (human behavior) Man's relation to the environment Cooperation with other men Foresight

SUGGESTED ACTIVITIES	
52. Open-ended discussion.	52. How D Bra S Ada A Mac S
FILM: Army Ants: A Study of Social Behavior. Color 12 min.	Fil
53. Open-ended discussion.	53. Lor S Bet S Ash S Hym De 1
Fourth Quarterly Achievement Test Form R & S.	
Processes of Science Test.	The St
BSCS Comprehensive Final Examination. Form J.	The St

UNIT 4: CONTINUNITY OF LIFE

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rm J.	The Psychological Corporation,304 East 45th Street, New York, New York 10017.